THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIV. No. 1380.] LONDON, OCTOBER 22, 1889. [41ST YEAR. Price 6d.

Ashmore, Benson, Pease, & Co., Ltd.

GASHOLDERS.
CONDENSERS.
SCRUBBERS.
PURIFIERS.
RETORT-APPLIANCES.
CONSTRUCTIONAL IRONWORK.
DAVIS'S SULPHATE STILLS.

STOCKTON-ON-TEES.

Illustrated Gas-Works Catalogue.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.

THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD,
LONDON.

WOLSTON'S
TORBAY PAINTS
TORBAY & DART PAINT Co., LIMITED,
23, GREAT GEORGE ST., WESTMINSTER, S.W.

CEMENT
EARLE'S
BEST
PORTLAND CEMENT
MANUFACTURED BY
GEO. & THOS. EARLE,
HULL.

PROMPT DESPATCH:
Seven Jetties on the River.
Two Private Railway Sidings.
FACILITIES FOR DESPATCH:
Six Railway-Waggon Entrances with Steam and Hydraulic Cranes.
Four Rully Entrances.
Three different Railway Companies within easy carriage distance.
Storage Capacity 8000 tons.
Office: 7, PIER STREET.
Works: WILMINGTON.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

SIMON'S
AMMONIA PLANT FOR GAS-WORKS.

Improved Continuous Distillation. Produces either Sulphate or Liquor Ammoniæ.
Extracts all Ammonia. No Clogging with Lime.
This Apparatus has been successfully at work for years in over 100 Establishments in England, Germany, France, and America.
HENRY SIMON, 20, MOUNT STREET, MANCHESTER.

C. & W. WALKER.

GASHOLDERS; PURIFIERS;
PURIFYING MACHINES;
CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;
SULPHATE & SULPHUR PLANT;
RETORT MOUTHPIECES; CONDENSERS;
LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;
SLIDE VALVES; TAR BURNERS; &C. &C.
WOOD SIEVES.

ADDRESSES:
8, Finsbury Circus, London, E.C.; Midland Works, Donnington, Salop.
"FORTRESS LONDON." "FORTRESS DONNINGTON."—Telegraphic.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMER'S WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE & EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

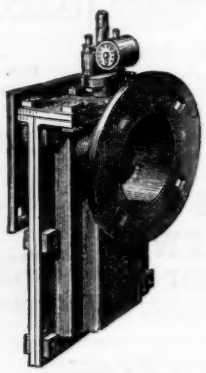
S. OWENS & CO., Hydraulic, Gas, & General Engineers, WHITEFRIARS ST., LONDON, E.C.

SOLE MANUFACTURERS OF

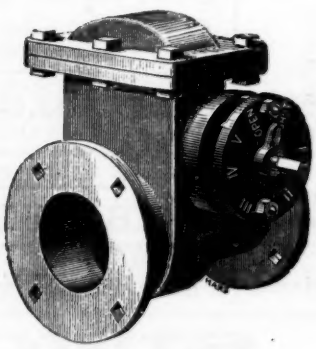
MANN & OWENS' PATENT SCREW & CAM, also FULL-WAY RACK & PINION GAS-VALVES.

REDUCED IN PRICE.

VALVE to OPEN DOWNWARDS.



BRIDGE VALVE
for Regulating the Seal
of Hydraulic Mains.



FULL-WAY RACK AND
PINION VALVE.

VALVE to OPEN UPWARDS.

Also Makers of Pillar Valves, Self-acting Bye-pass Valves, Outside Rack and Pinion Valves, Hydraulic Main-Valves, Disc-Valves, and Special Valves of all kinds. Improved Gas-Exhausters, Steam-Engines, Steam-Cranes, Boilers. Blake's Patent Steam-Pumps for Tar, Water, and Ammoniacal Liquor. Hydraulic Coal-truck Lifts, Hydraulic Cranes, Hydraulic Apparatus for Lifting Purifier-Covers, and every description of Pumping Apparatus, &c., suitable for use in Gas-Works, made to order.

S. O. and Co.'s New Catalogue of Gas Apparatus and General Machinery can be had on application.

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

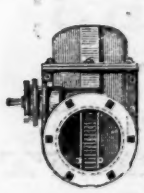
SLIDE VALVES,
WITH RACK & PINION,
OR
Internal or External
SCREWS, of all Sizes.

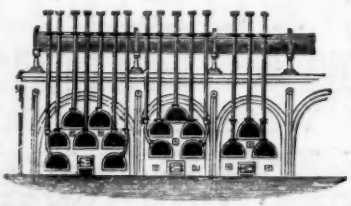
GASHOLDERS,
AND
Gasholder Tanks.

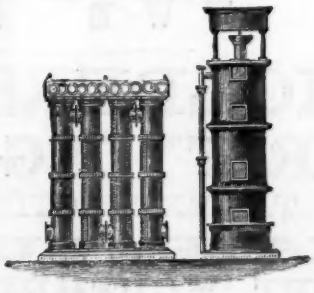
CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description.
Iron Roofs, Columns, Girders, Floor Plates
and Tools, &c.

WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS.
TAR AND LIQUOR PUMPS, &c.

PATENT
CENTRE VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.





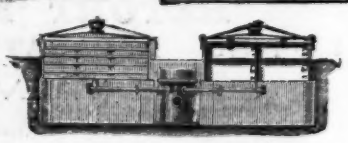


PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS.

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

THE BARROWFIELD IRON-WORKS, LIMITED,

Late LAIDLAW, SONS, & CAINE, Limited,

GAS ENGINEERS AND CONTRACTORS,

Telegrams: "GASOMETER GLASGOW."

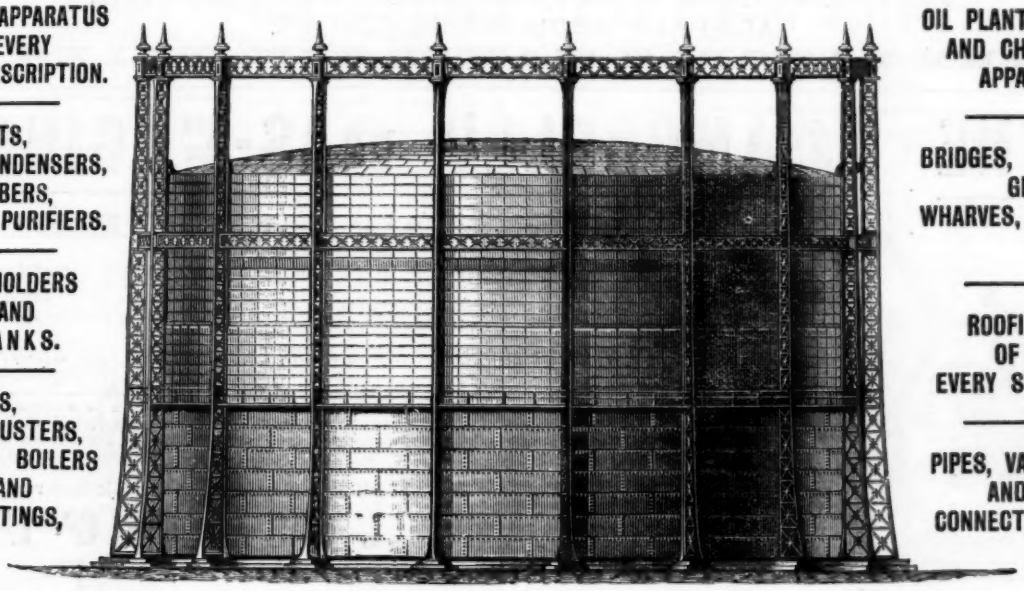
GLASGOW.

GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM BOILERS AND FITTINGS,



OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.

London Office: 6, LITTLE BUSH LANE, CANNON STREET.

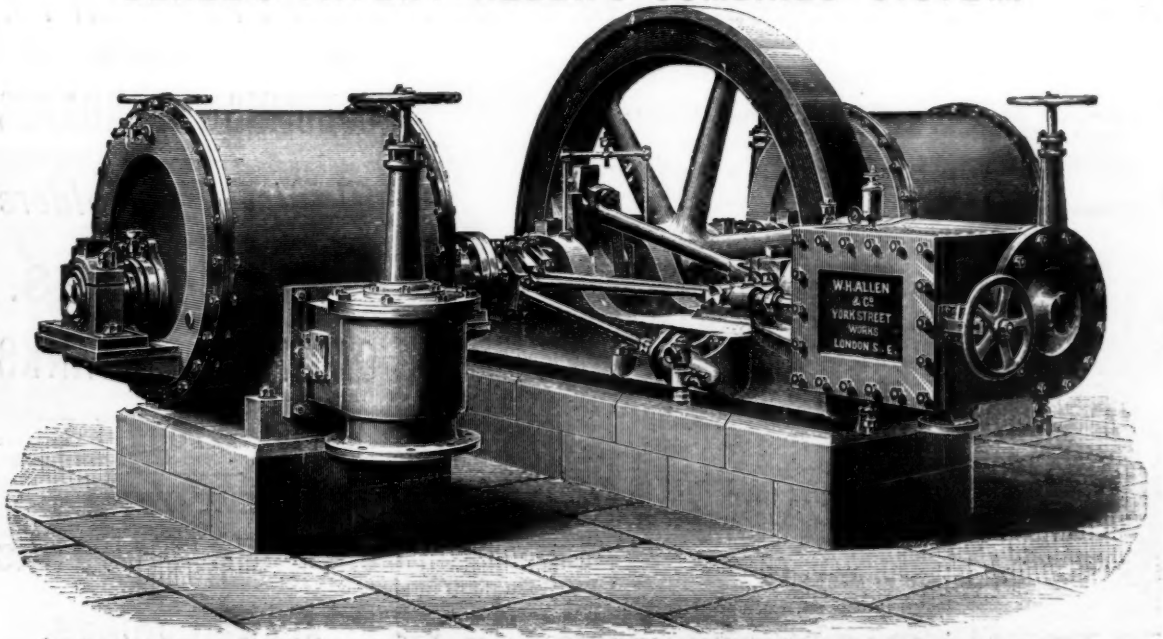
W. H. ALLEN & CO.,

York Street Works, LAMBETH, LONDON, S.E.,

MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.



Pair of Non-Oscillating Exhausters passing 200,000 Cubic Feet of Gas per Hour.

CAST-IRON PIPES, ETC.

THOMAS SPITTLE, LTD.

[ESTABLISHED OVER 50 YEARS.]

CAMBRIAN FOUNDRY, NEWPORT, MON.,

MAKERS OF

CAST-IRON PIPES FOR GAS, WATER, AND STEAM.

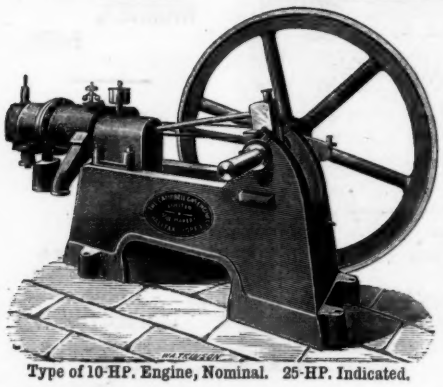
ALSO

Retorts, Mouthpieces, Lamp-Posts, Hydraulic Mains, H-Pipes, Dip-Pipes, Buckstaves, Ash-pans, Sight-Holes, Syphons, Ascension-Pipes, Fire Doors and Frames, Fire-Bars, Hydrants, Valves, Purifiers, Tanks, Columns, &c., &c.

ALSO ALL WROUGHT-IRON WORK.

THE LARGEST MAKERS IN WALES.

THE "CAMPBELL" GAS-ENGINE.



Type of 10-HP. Engine, Nominal. 25-HP. Indicated.

GREAT SUCCESS.

20 PER CENT. CHEAPER THAN ANY OTHER.

Gives the Highest Satisfaction with all kinds of Work.

Testimonial from Mr. JAMES MOON, Engineer to the Filey Gas-Works.

Feb. 9, 1889.

GENTLEMEN,—We have been using one of your Gas-Engines on our Works for about four months, and I have pleasure in saying that it does its work in a very satisfactory manner. The engine is half-horse power, steady in all its movements, and, with ordinary care, will drive the exhaust apparatus at an even gauge.—I remain, Yours respectfully,

(Signed) JAMES MOON.

For Price Lists and full particulars, apply to the Sole Makers:

THE CAMPBELL GAS-ENGINE CO. LIMITED,

WELL LANE, HALIFAX, YORKS.

R. & J. DEMPSTER,

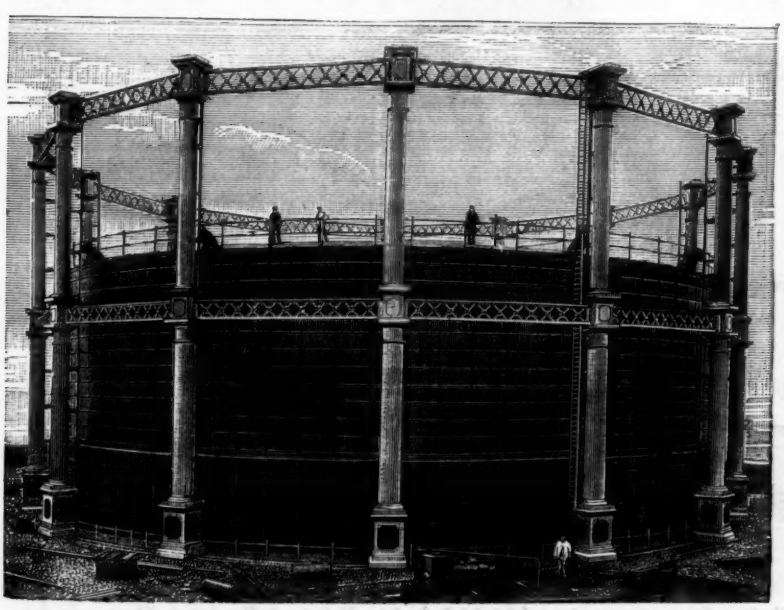
Engineers, Ironfounders, and Contractors,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

MANUFACTURERS AND BUILDERS OF

GASHOLDERS

In SINGLE, DOUBLE, TREBLE, or QUADRUPLE LIFTS,



With Cast or Wrought Iron

COLUMNS or STANDARDS

Single-Lift Holders

Converted into

TELESCOPES.

GASHOLDER TANKS

IN

Steel or Wrought Iron.

CAST-IRON

Gasholder Tanks

WITH

PLANED JOINTS.

CLAYTON, SON, & CO.

ESTABLISHED A QUARTER OF A CENTURY. LIMITED.

MANUFACTURERS OF ALL KINDS OF

GASHOLDERS

AND

GAS PLANT

OF EVERY DESCRIPTION.

LONDON OFFICE: 60, QUEEN VICTORIA STREET, E.C.

HUNSLET, LEEDS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY.

CHESTERFIELD

TRADE	TELEGRAMS:	LONDON AGENTS:
O X O	"JACKSON,"	BECK & Co.,
MARK.	CLAY CROSS.	53, QUEEN VICTORIA ST., E.C.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

Sole Agents and Manufacturers,

GODDARD, MASSEY, & WARNER, ENGINEERS,

NOTTINGHAM,

OR TO

MAURICE SCHWAB,

96, DEANSGATE, MANCHESTER.

The Apparatus has been supplied to the following Firms—

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (4 Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations:—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

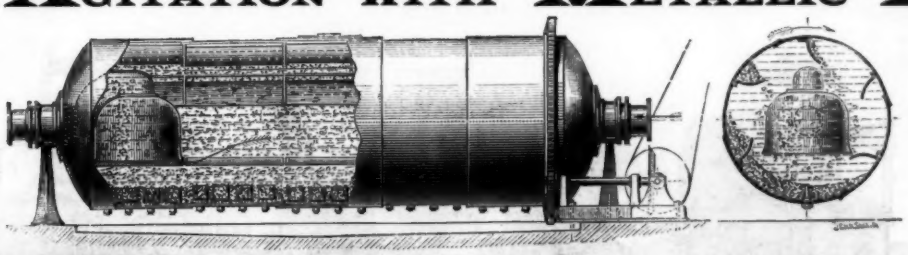
THE

REVOLVING PURIFIER

(ANDERSON'S PATENT)

For the Purification of River Water and Sewage Effluent in Large Volumes, and for Removing Colour from Water containing Peat or Clay,

By Agitation with Metallic Iron.



Made in fourteen sizes; capable of treating singly 5000 to 1¼ million Gallons per Day. Reduces Organic Matter from 45 to 90 per cent.; totally removes Microbes from Polluted Water.

A 1-inch Revolving Purifier capable of treating over 6000 gallons per 24 hours will be shown at work at the Brewers' Exhibition, Agricultural Hall, Bay 6a.

GOLD MEDAL, INVENTIONS EXHIBITION, 1885.

Revolving Purifier Company, Limited,

DOCK HOUSE, BILLITER STREET, LONDON, E.C.

TELEGRAPHIC ADDRESS, "GAS LEEDS."

LONDON OFFICE, 60, QUEEN VICTORIA ST. E.C.

CLAYTON SON & Co LIMITED, LEEDS.

MAKE

RETORT LIDS

OF ALL FORMS & SHAPES IN IRON OR STEEL BY SPECIAL HYDRAULIC MACHINERY.

PRICES ON APPLICATION.

WASHER-SCRUBBER AND SLOW-SPEED CONDENSER

(KELMAN & HENDERSON'S PATENTS)

These Apparatus are in use at the Gas-Works at Lincoln, Mountain Ash, Neath, Ellesmere (Salop), and Woodstock (Capetown); and

Two large CONDENSERS capable of dealing with **2,000,000** cubic feet of Gas per day are in course of Manufacture for the Gas-Works at Sheffield.

For Prices and further Information apply to

J. A. KELMAN, Winchester House, London, E.C.

F. & C. OSLER,

(ESTABLISHED 1807)

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES,

TABLE GLASS OF ALL KINDS,

CHANDELIERS IN BRONZE AND ORMOLU.

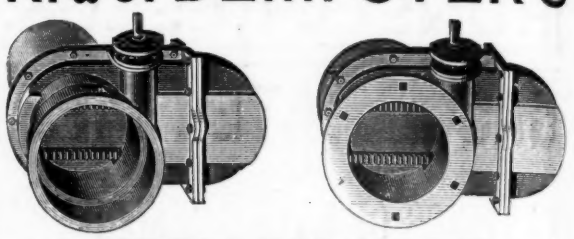
MODERATOR LAMPS.

100, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

R. & J. DEMPSTER'S



TESTED GAS-VALVES.

The pinions of all our Slide Valves are now cut by special machinery from solid forgings. Valves of 10-in. bore and upwards are fitted with double racks, without extra charge. The flanges are all faced and made to standard dimensions, unless otherwise ordered. All valves are tested and guaranteed tight before leaving the works.

Upwards of 200 Valves kept in stock to facilitate quick delivery.

Prices and Dimension Lists sent on application.

All kinds of Faced and Hydraulic Centre and other Valves made to order.

GAS PLANT WORKS,

NEWTON HEATH, MANCHESTER.

London Office: 181 and 182, GRESHAM HOUSE, OLD BROAD STREET, E.C.

R. DEMPSTER & SONS, Ltd.,

ESTABLISHED 1855.

ROSE MOUNT GAS ENGINEERING WORKS,

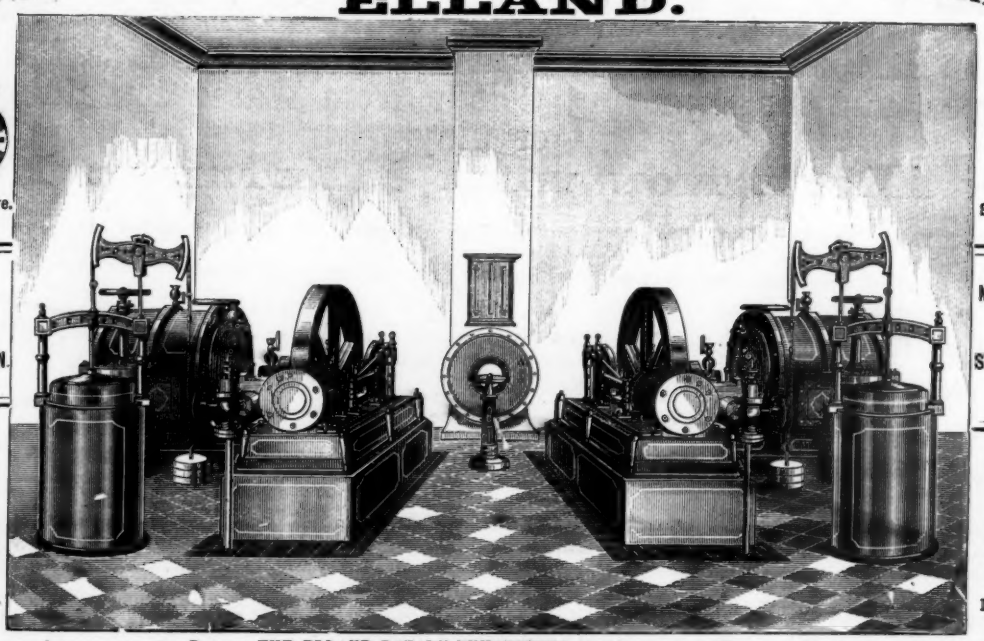
ELLAND.

No. 1. Flange Valve.

NO SLIP.

NO OSCILLATION.

No. 3. Screw Valve.



No. 5. Screw Valve.

NO HIGH SPEED.

STEADY GAUGE.

No. 6. Disc Valve.

THE ABOVE IS AN ILLUSTRATION OF A PAIR OF THE ELLAND ROTARY EXHAUSTERS ERECTED BY US AT WIGAN, EACH OF WHICH ARE CAPABLE OF PASSING 80,000 CUBIC FEET OF GAS PER HOUR.

Makers of every other description of Gas Plant, including Retorts, Retort Mountings, Condensers, Washers, Tar and Liquor Separators, Scrubbers, Purifiers, Gasholders any size, Patent Centre-Valves, Four-Way Valves, Rack, Screw, and other Valves.

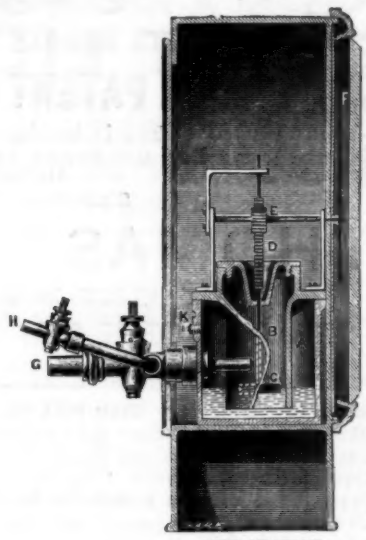
Testimonials and References on Application to

DEMPSTERS', ELLAND.

MERCURIAL GAS PRESSURE-GAUGE

HARRISON & SHEARD'S PATENT.

FRONT ELEVATION.



SIDE SECTION.

This most convenient and portable appliance is constructed on the principle of the well-known "King's Gauge," but with mercury to operate the float instead of water. There are two sizes—one showing 13 inches, and another 26 inches pressure; and when required, the dial of either may be arranged partly to show vacuum and partly to show pressure. These Gauges may be carried about without any danger of the mercury escaping.

In the side sectional view **A** shows the inlet "leg" of the Gauge, and **B** shows the outlet "leg." **A** is concentric to **B**, as in "King's Gauge."

C is the float which carries the shaft that operates the rack and pinion shown at **E**; whilst **F** is the indicating pointer.

G is the inlet gas-tap, and **H** is the vent-tap—bent upwards to allow inlet to be seen.

The "ink bottle" arrangement of the upper part of the chamber **B**, together with that of the inlet for gas, makes it impossible for the mercury to escape.

These Gauges were fully described in the "JOURNAL OF GAS LIGHTING" for Jan. 17, 1888 (page 106).

Particulars and Prices on application to

W. & B. COWAN,

ESTABLISHED 1827

SMITH SQUARE WORKS, WESTMINSTER, LONDON, S.W.

DUTTON STREET WORKS, MANCHESTER.

BUCCLEUCH STREET WORKS EDINBURGH.

ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.
Since then we have not Exhibited for Prizes.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

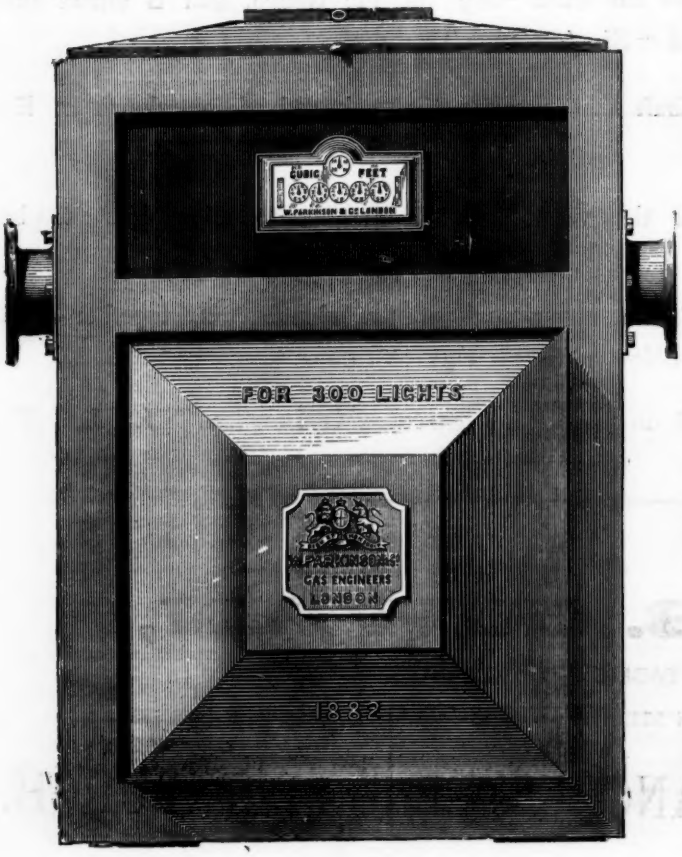
214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

TELEGRAPHIC ADDRESS: "GOTHIC LONDON." TELEPHONE No. 6725.

1st—Are a remedy for all the defects of Wet Meters.
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by Frost, however severe.
5th—Are the most accurate and unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

METERS FITTED WITH GREY'S INDEX OR HARDING'S COUNTER.

W. PARKINSON & CO.,



MANUFACTURERS OF

DRY METERS

OF THE

VERY BEST QUALITY.

The DIAPHRAGMS are of the Finest PERSIAN SHEEP SKINS.

The CASES are of the Best CHARCOAL-TINNED PLATES.

WET METERS,

With PATENT THREE-PARTITION DRUMS.

STATION METERS & GOVERNORS,
PRESSURE & EXHAUST REGISTERS,
MOTIVE POWER METERS,
Test Gasholders, Experimental Apparatus, &c.
PRESSURE GAUGES OF EVERY DESCRIPTION.

NEW ILLUSTRATED CATALOGUE & PRICE LIST
Sent post free on application.

GOLD & SILVER MEDALS,
International Health Exhibition, London, 1884.
SILVER MEDAL,
International Inventions Exhibition, 1885.

COTTAGE LANE, CITY ROAD,
LONDON.

Telegraphic Address: "INDEX LONDON."

See also Advt., p. 812.

CONTENTS.

EDITORIAL NOTES—*Gas, Lighting, &c.*:— PAGE
The Bristol Strike and other Labour Topics . . . 781
The Midland Gas Managers . . . 782
The Condition of American Workmen . . . 782
Dr. Joule . . . 783
Water and Sanitary Affairs:—
The London County Council and the Water Undertakings . . . 783
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 784
Electric Lighting Memoranda . . . 784
Midland Gas Managers at the Compressed Air Company's Works . . . 785
Chemistry for Engineers . . . 786
Ammonia and Ammonium Compounds . . . 786
NOTES:—
Asbestos Sealing for Retort-Lids . . . 787
The Woodbury-Merrill Hot-Air Engine . . . 787
The Metric System in Chemistry and Engineering . . . 787
COMMUNICATED ARTICLES:—
The Difficulties of Conducting Enterprises in South America, especially as regards Brazil. By "Brasileiro" . . . 788
The Chemistry of Illuminating Gas. By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S. . . . 788
TECHNICAL RECORD:—
The Energy Relations of Gas and Electric Lighting . . . 790
REGISTER OF PATENTS:—
Manufacture of Gas—The Gas Patents Syndicate, Limited (Archer, J. B.) 791
Lighting and Extinguishing Gas Lamps—Lake, H. H. (Shaw, N. H. and A. B.) . . . 791
Ammonia Stills—Davis, G. E. . . . 791
Gas Lamps and Burners—Bruers, L. . . . 792
Water Gas—Langen, J. von., and Cooper, L. . . . 792
Patent Notices . . . 792
CORRESPONDENCE:—
The Wire-Rope and Spiral Systems of Guiding Gasholders . . . 793
MISCELLANEOUS NEWS:—
Gas Workmen and the Labour Question . . . 793
Letting Gas Stoves on Hire as an Organized Business . . . 794
The Municipal Gas Undertaking in Philadelphia . . . 795
The Origin and Uses of Petroleum . . . 795
Gas Undertakings in New Zealand . . . 795
Stockton and Middlesbrough Corporation's Water Supply—The Half-Yearly Report of the Water Board; The Proposed Application for Additional Powers . . . 797
The Water Supply Arrangements at the Paris Exhibition . . . 797
Notes from Scotland . . . 798
Current Sales of Gas Products . . . 799
Gas and Water Companies' Stock and Share List . . . 800
Recording River Volumes and Flood Levels, 783—Stoppage of the Electric Light in New York, 784—Laying Mains under Water, 784—Presentation to Mr. R. Pierson, 786—Asphalte Pavements Injured by Escaping Gas, 796—The Conference on the New Railway Rates, 786—Sale of Stock in the South Metropolitan Gas Company, 786—The Smoke Abatement Question in the Metropolis, 786—Rolling Liquid Metal, 789—The Price of Coal and the Cost of Pumping Water, 790—Sale of Shares in the Rickmansworth Gas Company, 793—The Condition of the Dunedin Corporation Gas-Works, 793—The Price of Gas in the Salford Out-Districts, 793—Explosion of Gas at the Leeds Town Hall, 793—The Hindley Local Board Gas Undertaking, 793—The Stopcock Question at Folkestone, 794—Extension of the Rawmarsh Gas-Works, 796—The "Shooting Incident" of the Bristol Gas Workers' Strike, 796—Uxbridge Water Supply, 797—The Unsanitary Condition of Sutton (Hull), 797—The Gas Supply of Birkenshaw, 797—The Ashton-under-Lyne Gas Company and the Price of Gas, 799—The Price of Gas at Brough and Elloughton, 799—The Todmorden Local Board and the Water Supply, 799—Sale of Stock in the Maidstone Gas Company, 799—Projected Extension of the Mid-Kent Company's Water Supply, 799—The Vyrnwy Works, 799—Fylde Water Company, 799—The Unsightly Electric Lighting Poles at Weybridge, 799—The Quality of Bristol Gas, 799—The Drainage of Margate, 799—The Proposed Extension of the Shrewsbury Water-Works, 800—Proposed Electric Lighting of Launceston (Tasmania), 800—The London County Council and the Water Supply, 800—Proposed Amalgamation of Nelson with Brierfield, 800—The Northern Coal Trade, 800—The Sheffield Water Department and Outside Plumbers, 800—Proposed Storeage Reservoir for Plymouth, 800—The Newbury Corporation and the Water-Works, 800.

TO ADVERTISERS.

ADVERTISEMENTS for the next number of the JOURNAL must be received by Monday, 12 o'clock noon, to ensure insertion; but as the Advertisement sheet of the JOURNAL is sent to Press the first thing on Monday Morning, Advertisers will please bear in mind that Orders for Alterations in or Stoppages of PERMANENT Advertisements should be received Not Later than Two o'clock on SATURDAYS.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 22, 1889.

THE BRISTOL STRIKE, AND OTHER LABOUR TOPICS.

It is with the greatest distaste that we find ourselves constrained again this week to mention the recent *fiasco* at Bristol. With a very good will, we would have dropped the painful subject, never to take it up again, and have left the affairs of the Bristol Gas Company to settle down as best they might under the new conditions created by the mismanagement of the recent labour trouble; but we have no choice in the matter. Last week we commented upon the affair in terms which have been shown, by communications that have since reached us, to express the sentiments of the great bulk of members of the gas industry of the kingdom. What the local public of Bristol and the West of England think of the conduct of the Bristol Company, the Directors and shareholders have had ample means of learning from the newspapers circulating in the district. There is one chorus of condemnation for the men at Bristol who have jeopardized the most serious interests by conduct superlatively foolish and feeble. The local discontent is evaporating in the usual way, in letters to the newspapers, in which the real point at issue is in danger of being lost in vague complaints of the quality and price of Bristol gas; and the Directors are assured by local editorial wisdom that if the manufacture of gas had stopped entirely, the public could have borne with the deprivation of the questionable product more easily than with the reflection that mob force has been permitted to score such an easy victory in the city. It remains for us, however, to do an act of justice by not permitting the blame due for a piece of disastrous mischief to rest upon the wrong men. When we wrote upon the subject last week, we only knew that somebody had made a decided mess of the business; and while declaring the fact, we could not assign the blame to anybody in particular. Consequently we were obliged to use such general terms as the "Bristol "people," the "Company," and so on, to express the culpable parties. Very reasonably, some of the persons who would ordinarily be included in these descriptions, yet who do not feel inclined to be condemned for the failure of arrangements in the making of which they were not concerned, wish to have the question of culpability more clearly settled. It is therefore with the desire to do what is right in this unpleasant and delicate matter, and with a full sense of the gravity of the statement, that we now declare that information in our possession warrants the absolution of the three Engineers of the Company—Mr. W. Fiddes, Mr. E. J. Lloyd, and Mr. D. Irving—from all blame either for causing the men to strike, or for the mismanagement when the emergency arose. The whole business was taken in hand by the Secretary (Mr. J. V. Green), who seems to have assumed all authority for dealing with the men, whether by sanction of the Directors or not, and then at the critical moment, when nobody else knew what arrangements had been made for manning the works, proved utterly incapable of ruling the storm which he had raised. Mr. Green's conduct throughout the whole affair showed that it was his intention to reduce the Engineers to practical impotency, if he could, and to pose as the Napoleon of the time and occasion. If his measures, such as they were, had succeeded, he would have taken all the credit to himself, and the Bristol Gas Company would thenceforward have been Mr. Green and nobody else. Half-a-dozen brickbats and an overturned cart were, however, sufficient to upset all his forcible-feeble plans. Of him a local satirical journal declares that he "seems to have pleased "neither the Directors, the stokers, the newspapers, or the "outside public; and the sooner he packs up, bag and "baggage, the better for all concerned."

It is a bad job for Mr. Green, who may well wish he had remained in the safe obscurity of the Manchester Town Hall; but if he is in hot water, he lit the fire himself. It will not do to see the whole gas industry, and the good names of many worthy gentlemen who know something of working men and their ways, blackened before the world just because an ambitious Secretary tries to grasp more than he can hold. We blame the Directors as well for letting matters go so far. There is talk about the expense to the Company of the strike and the breakdown, for it is probable that every man engaged from outside, on the promise of several months' work and protection, will have a claim upon the Company; and there are too many lawyers in Bristol to let slip such a good business opening. It is even feared lest the price of gas may be increased. Although it is, of course, quite possible that this may have to be done for legitimate reasons connected with the advanced cost of labour, it would be scandalous for the consumer to be saddled with a penny of the expenses incurred through the Directors' mismanagement. Their own fees ought to be stopped, to begin with, until their blunder has been paid for; and they who have so many times taken votes of thanks and complimentary resolutions on the part of the shareholders ought now to bear their share of the consequences of their folly and misplaced confidence.

Whether as the result of their easy victory at Bristol, or merely because the movement is "in the air," rearrangements of gas workers' labour and pay are in progress or actually completed all over the country. It is impossible to regret this, for the levelling-up process was inevitable; and there is no reason why gas stokers in one town should have advantages denied to their fellows elsewhere. It will be all the more easy for managers to deal with their men when they know the latter cannot "better themselves" by going into the next town; and it is not at all likely the Companies will be ruined by such additions to their wages account as may be needed to bring to pass such a condition

of affairs. A good deal of bickering may be expected to attend some of these negotiations, and the sudden preponderance of the Union in fresh places may be marked with an infinity of petty irritations; but it is necessary to exhibit forbearance in dealing with such troubles. To the employers we would counsel patience, and still again patience, and once more patience. It is naturally annoying to a man whose will has been law in his works to receive intimations that other wishes than his own must be consulted; but there is no help for it. Gas Companies and Corporations can never go to the extremity of a lock-out upon trivialities, even although these may be gall and wormwood to the Works Manager. All that can be done is to take careful note of these things by way of preparation against a moment when "the string may be "pulled too far," and when the question of who is to rule may have to be fought out to the end. It may be trusted, however, that no Gas Company will go into a strife of this nature "with a light heart," for a small cause, or except to win. One Bristol is enough for a kingdom. We do not like to contemplate such an eventuality as a lock-out of gas workers; but should it come, the Manager who undertakes it will understand in advance that he must rely upon his own forces, man for man, against the enemy. It will be the life-and-death struggle of the Union; and so it must be for its opponent. No Gas Manager in such a case who knows his duty would go to a Police Superintendent for help in the works. He might warn the peace-officer that disturbances were to be expected; but unless he could say, "You look after "the town, and I will hold the gas-works," it would be idle to count upon victory.

It is desirable also to address a word to the managers of the Stokers' Union, which we trust they will take in good part. It is that they should keep a tight hand upon the branch officials, and check the latter from precipitating quarrels by irritating and superfluous displays of their new-found influence. We have no reason to believe that the head men of the Union have the slightest desire to render the Society unbearable; but there is considerable danger of the minor officials showing an arbitrary spirit, and threatening the exercise of the power of the organization with reference to trifles. If this is permitted, matters will come to such a pass in some places that Directors and Engineers will feel open war to be preferable; and a crisis will come that might have been avoided. The employers will not resort to a lock-out save at the last extremity; on the other hand, they cannot have their men threatening to throw down their tools two or three times a week on account of petty infringements of Union rules by somebody in the works. For example, the employer cannot be made use of to enforce payment of Union subscriptions. He cannot stop the money out of wages, as he would a sick-fund contribution. Again, there should be a little more steadfastness on the part of the men in carrying out their engagements. Take the instance of the South Metropolitan agreement, when the men promised not to object to the employment in the same retort-house of non-Society with Society men, provided they were not asked to work in the same gangs. Now they appear to betray a desire to break this engagement, and to insist upon the removal of all stokers who do not belong to their Union. Indeed, it is pleaded by some of the men's spokesmen that they forgot to insert in the agreement a clause enabling them to "ask" non-Union men employed in any capacity in the carbonizing department to join the Society, and in the event of their refusal to do so within a period of seven days, engaging the Company to remove them to some other employment. The remarkable part of it is that some of the men, having discovered thus late in the day that they omitted to make this stipulation, are acting precisely as though it had been duly agreed to, and are threatening to leave their work unless non-unionists are driven out of the retort-houses. This is neither right nor reasonable. If it is not "coercion" in a most objectionable form, perhaps Mr. W. Thorne, or somebody else, will tell us what is. Mr. Thorne is an astute man, for whom we would fain preserve our respect; and he must surely see that encroachments of this kind strike at the very root of amicable understandings between employers and employed. It is useless to arrange compromises and agreements if one side is to upset them at will.

This is a critical time in the history of the gas industry, and we are endeavouring, to the extent of our power, to serve both employers and their workmen by holding out the balance fairly between them. It would be a pity to see the gas stoker extinguished by the adoption of mechanical appliances which any man out of the streets could work; but it must be confessed that it will come to this unless the men are reasonable. There never was such a stir in the minds of gas directors and committeemen as at the present time, with regard to the possible revolutionizing of the work of gas making; and it will be in the highest degree imprudent for stokers to act as though they might be troublesome with impunity because they are indispensable. So surely as they do this, and a machine can be found to replace a man in gas making, even at a little extra expense, in will go the machine and out will go the man.

THE MIDLAND GAS MANAGERS.

In another column will be found an account of the meeting last Thursday of the Midland Association of Gas Managers in Birmingham, when the members present discussed Mr. J. Ferguson Bell's and Mr. W. T. Tew's papers, and visited the works of the Birmingham Compressed Air Company, besides bidding farewell to Mr. Taylor, of Derby, in the capacity of President, and electing Mr. H. Peaty, of Burslem, in his stead. The principal contributor to the discussion on Mr. Bell's paper was the author, who delivered what practically amounted to a second paper on the same subject, in the shape of a reply to his critics, friendly and otherwise. Here it may as well be remarked that most of his readers will be disposed to think Mr. Bell better in exposition than in argument, for some of his logic was decidedly shaky, though his conclusions were, on the whole, sound. Mr. Tew's paper was just the kind of matter that suits a District Association of Gas Managers; and the author has done good service by bringing up for discussion such an important, and at the same time generally ignored subject as the elements going to make up what is known as unaccounted-for gas. The works of the Compressed Air Company are very interesting to gas managers, seeing the close resemblances (with the striking differences) that exist between the production and distribution of gas and air under pressure. Both require main-pipes, services, and pipe-fittings, besides meters and pressure indicators; but the similarity between the two classes of undertakings in one aspect only serves to heighten their differences in every other. It was generally agreed among the visitors to the air-power works on Thursday that the plant was admirably designed and put down, and that the working out of the business would probably prove a very interesting experience. With regard to the commercial prospects of the venture, however, little was said. It will be admitted that if a scheme of the kind may be expected to succeed anywhere, Birmingham is the place for it. Yet for all that has been done by the Popp Compressed Air Company in Paris, it is still a hazardous experiment—just the sort of thing, in fact, of which outsiders will be certain to say "I told you so," whether it turns out successful or disastrous. The Company can underbid gas-engines at the price of gas in Birmingham; and there is the further advantage that a new power-user on the line of air-mains need only purchase an engine, without going to the expense of a boiler, which will only stand him in half the cost of a gas-engine. What they may pick up in the way of refrigerating by expansion of air, ventilation, or in other special applications, cannot be predicted; but on the question of power distribution pure and simple, it looks as if the Company will have all their work before them to earn a heavy dividend. This question is what the Company have to solve within the next year or two. We wish them prosperity, especially as their success must mean a diminution in the amount of smoke and dirt with which Birmingham, like all manufacturing towns in the kingdom, darkens its own streets and afflicts its neighbourhood.

THE CONDITION OF AMERICAN WORKMEN.

It will perhaps be remembered that during the past summer a number of American newspapers raised a fund with the object of paying the expenses of a party of representative workmen, collected from different parts of the United States and practising different trades, who were to visit England and France, and make observations on the condition of European trade and industry. They came, attended by photographers, shorthand writers, and, in brief, a whole staff of people competent to reduce to writing the reports which the experts were expected to submit in acknowledgment of the help they had received. These reports may or may not be worth the money they have cost; but the cream has been taken off whatever statements may yet be forthcoming by the enterprising interviewers, who, of course, pounced on the party the moment they returned to New York. In view of

the existing agitation among the labouring classes of this country, with a view to obtaining more money and shortened hours of work, it is interesting to notice what most of these American workers gave as the gist of their observations while here. It may be mentioned that many British establishments to which the inquiring workpeople and their photographers and reporters would have dearly liked to gain access did not quite see the matter in the same light, and accordingly became Protectionists for the nonce, like their visitors when at home, by keeping to themselves what they were doing and how they were doing it. This attitude of reserve was naturally annoying to a people who are always so liberal in their own treatment of foreign work and workers; and most of the party take their revenge by running down everything they saw over here, and giving the sympathizing newspaper reporters to understand that, the United States being the acme of Creation, they had not learnt anything while they were away from home. It is a pity, in this case, that the trip cost so much money, and that the tourists ever left the workshops they doubtless illumine. All the same, one admission was made by the whole party which should not be lost sight of. They held the opinion that the American is more productive than the foreign workman, partly because "the American works harder and for "longer hours, and with fewer holidays, than the foreigner," but mostly because of the "vast superiority" of the American machinery. This latter point is something for the employer, and cannot directly affect the workman who is paid for his time. "The workmen take life easily," says one man, who evidently thinks there is something in this idea; and the best a president of a miner's organization can say is that, "on the whole, I think we are better off." It is clear that the United States is not the country for men who appreciate short hours, although the slavish handicraftsmen of the Continent, who are accustomed to work twelve hours a day, would find it a great improvement in respect of pay.

DR. JOULE.

When the announcement of the death of Dr. J. P. Joule appeared in the newspapers last week, many of the younger order of students of physics might have been surprised to learn that the man who did so much for the establishment of the great principle of the Correlation of Forces, without which so much of modern Science would be mere empiricism, had been so recently numbered among the living. Young men might be excused for thinking of Joule as they do of Watt, Dalton, Davy, or Faraday—as an inhabitant of the earth during the days of the giants. Of a truth, he was a relic of the heroic age of physical science, when, as it appears to students of this later day, there were whole continents to be reduced to the sway of Science, as compared to the peddling discoveries that occupy the philosophical record of the present. What Lyell did for geology and Darwin for the history of life upon the earth, that Joule and Grove did for the cosmical forces. If Joule had not determined the mechanical equivalent of heat, Tyndall would not have had the raw material for some of his most brilliant work, and mechanical engineering would have been as much a groping in the dark as chemical industry was before the atomic theory. When we draw up the balance-sheet of a steam-engine or a gas-engine, and check the performance by the possibilities, it is on the work of Joule that we rely. His great experiment stands alone in the history of modern science, as a model of the way to unlock the secret things of Nature. He put the question, as one may say, and Nature answered him with an eternal verity such as falls to the lot of few men to receive. There has been some comment upon the indifference with which the announcement of Dr. Joule's death has been treated by the newspaper-reading world. If he had been a third-rate politician, a second-rate actor, or a first-rate jockey, columns of obituary notices would have appeared in the newspapers, and the event would have been a nine-days' wonder. The appearance of neglect of Dr. Joule's great name means nothing more, however, than the fact that he did not cater for the multitude. Many years have elapsed since he did anything calculated to draw all eyes to his abode in Manchester; but such fame as he won does not depend upon newspaper acknowledgments. When the record of the men who in the present century made science the foundation of mechanical industry comes to be compiled, the name of Joule will be there, and that is the memorial that would be preferred by the man himself, who was as unaffectedly modest and averse to personal advertisement as he was unremitting in the pursuit of knowledge. Not only in what he did, but in what he was, Dr. Joule stands as an example of the self-forgetting student to whom science is its own reward.

Water and Sanitary Affairs.

Various attempts were made during the recent session of Parliament to bring the Metropolitan Water Companies within the grip of the London County Council; but without success. The Council tried to carry a clause in its Money Bill, whereby it would have been enabled to spend money on an "inquiry" into the London Water Supply. This so imperilled the passing of the Bill that the entire measure had to be withdrawn, and another Bill substituted, omitting the objectionable clause. A Water Bill of which the late Mr. Firth had charge, speedily vanished; and we are now told that it was "not proceeded with." Other measures bearing on the same subject made their appearance, but came to grief. The question, however, is not to be allowed to rest. The Council's Special Committee on Water Supply and Markets, of which Mr. James Beal is Chairman, have a report in readiness, recommending that the Parliamentary Committee be instructed to prepare and introduce into Parliament during the coming session a Bill similar to the measure which it was decided to bring forward in the past session. The projected Bill, therefore, is to enable the Council to institute and to carry on "inquiries and negotiations with respect to the "supply of water in or near the Metropolis, and to introduce "Bills into Parliament relative to the subject." Power to "negotiate," and to introduce a Bill giving force to the negotiation, may lead up to the attempt we have before intimated—to purchase one undertaking as a means of fighting the rest. Of course the real aim of the Council is to get all. On the other hand, the power solicited, even though conferred, may lead to nothing practical. The Council may prepare a scheme, and it may fail to gain the sanction of Parliament. Can Mr. Beal and his colleagues devise a plan by which the water supply of London shall be rendered cheaper and better than it now is? More abundant it need not be. But if the supply can be sensibly improved and cheapened, let us know how it is to be done. It was said some years ago that the way to get cheap gas was to steal it. So, also, if in any way the London Water Companies can be made to surrender their property for less than its fair value, the County Council may share the plunder with the consumer. As for introducing an entirely new and competing supply, a more prodigal waste of public money can hardly be conceived—to say nothing of the huge breach of faith on the part of Parliament towards the Companies which such a proceeding would involve. The question really lies in a very narrow compass. If it is thought desirable for the County Council to have possession of the water supply, that body has simply to pay such a price as shall not inflict any wrong on the present possessors. But, first of all, it should be clearly seen whether any advantage would accrue to the public. The County Council has "stomach" for many things; but Parliament and the ratepayers may be expected to consider whether the appetite is one to be fed. At all events, it looks like a tremendous experiment, to place the water supply of what will soon be six millions of people in the hands of a newly-created body having no experience on such a subject. The County Council may wish to be big; but the inhabitants of the Metropolis and its environs want to be safe. The area supplied by the Metropolitan Water Companies contains a population equal to that of all England in the reign of George I.; and London (without the outlying parts) has now an average of half-a-dozen fires per day. The efficiency of the main drainage system, and the health of the people, as well as their security against an uncontrollable conflagration, are thus dependent on the constancy and abundance of the water supply.

Recording River Volumes and Flood Levels.—At the recent meeting of the British Association, Mr. C. E. De Rance, Secretary of the Association Committee on Underground Waters, brought the subject of river volumes and flood levels before the Mechanical Science Section. He expressed the opinion that the basis of any legislation for the amelioration of floods should be an accurate knowledge of the levels reached by the dry-weather flow, the average flow, and the flood condition of our streams, extending over a long period. At present such information is rarely obtainable; and, except in water-works drainage areas, but few observations exist as to the actual volume of water run off daily by the rivers of this country. He thought there could be little doubt that a permanent record of the height of floods, and the volume of the daily flow of our streams, is a matter of national necessity; and he was of opinion that such records could easily be obtained by the County Councils throughout the kingdom, if the Local Government Board would sanction observations being carried out by county officials.

Essays, Commentaries, and Reviews.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 800.)

The past week has been rather barren of interest in the Stock Markets. The settlement was the chief feature; and it was a heavy one. The general tendency at first was favourable to an advance in prices. But by mid-week the tide was setting rather the other way, though not strongly; and owing partly to more Jewish holidays, the close was quiet and rather dull. The Money Market remains in about the same fairly easy condition. The Gas Market has been pretty brisk. In Gaslight issues, the remark we made last week—that "A" seemed inclined to be firmer—was realized to a certain extent; for the stock rose 1 in the course of the week. It was, however, unable to maintain the advance, and fell back on Saturday to the old price. A large number of transactions in it have been marked, with 250 as the top figure. The secured issues too have not been neglected; and the prices recorded were not bad. With the exception of a little business on Friday in the "B" at middle figures, South Metropolitans have been quite stagnant. Of this Company's debenture stock which was offered at the Mart on Friday, only some £25,000 was disposed of—realizing an average price of about 137¼ per cent. At this price, the 5 per cent. stock returns £3 13s. per cent. interest; and a Company that can raise capital at so light a charge upon its earnings is in a position to be envied by many. Nothing at all has been recorded in Commercials; but the stocks are now quoted *ex div.* at cheaper rates by 3 in the case of the old stock, and 2½ in the new. Suburbans and Provincials have not been dealt in; but, on *ex div.* adjustment, Alliance and Dublin shows out rather easier. In Foreigners, the feature has been the announcement of an extra 1 per cent. bonus for the half year in Imperial Continental, which sent the stock up 7½ at a bound; though why one should give £7 10s. more for that which is going to return an extra £1 is not quite apparent. Other movements are rather irregular. Continental Union and San Paulo are a little higher; and Ottoman a trifle lower. Bahia and Malta have been firm. Water was very quiet most of the week, but grew more active on Friday and Saturday. The changes, though few, are favourable, comprising a rise of 2 in East London, and 1 in Southwark ordinary.

The daily operations were: Quietude was the rule in Gas on Monday, and prices were good. Nothing to note in Water. Business in Gas continued rather restricted on Tuesday, without any change of quotations. A fair proportion of the transactions marked was in Gaslight secured issues. On Wednesday, dealings were almost entirely confined to Gaslight "A" and Imperial Continental; but neither moved. Commercial new fell 2; and Alliance and Dublin new and Ottoman, ¼ each. Water was a blank. Gas was more active on Thursday, specially Gaslight "A," which rose 1. Imperial Continental advanced 7½. East London Water was 1 higher. Friday's business in Gas was largely in Foreign undertakings; all quotations standing unchanged. Water was quite active, especially debenture stocks. Southwark ordinary rose 1. On Saturday hardly anything in Gas was touched except Imperial Continental, which was firm and active. Gaslight "A" fell 1; and Commercial old, 3. In Water, East London rose 1 more.

ELECTRIC LIGHTING MEMORANDA.

THE PORTSMOUTH ELECTRIC LIGHT COMPANY—THE EARL OF CRAWFORD ON THE DEPTFORD STATION—THE TENDERS FOR ELECTRIC LIGHTING FOR THE CITY OF LONDON.

Prospectuses of electric lighting companies are flying about all over the country, to judge from the specimens that find their way to the office of the Journal week by week. Most of these ventures are got up by one or another of the speculative companies to which we have had occasion to refer from time to time as hunting about for the nearest English equivalent for "concessions;" and all require to be regarded with the greatest caution. It cannot be too strongly emphasized that there is no earthly advantage, but very much the reverse, in binding a local electric light company to any of these roving combinations. They do not want the local element without their money; and having the money, the local company had far better remain free to lay it out to the best advantage. Take, for example, the Portsmouth and South Hants Electricity Supply Company, which is to have a capital of £50,000, in 9000 ordinary £5 shares and 100 founders' shares. The project is for the payment of a 7 per cent. dividend on the ordinary shares; and then the surplus profits are to be divided equally between the ordinary and founders' shares. As there are so many of the former and so few of the latter, the partition will be curious, if it ever takes place. We wish the holders joy of the arrangement, at any rate. There are seven Directors named, and although none will be left for the shareholders to appoint, Mr. Robert Hammond, Managing Director of the House-to-House Electric Light Supply Company, Limited, will join the Board after allotment. The principal work the Board have to do is to fulfil the terms of a contract to pay £25,950 to the House-to-House Company for plant described as a duplicate, except as to offices, of this Company's Kensington station. No information is offered as to the capacity of the plant so contracted for; but it is pretty safe guessing that an independent local company with cash in hand could get as good, or better, in the open market for (say) 30 per cent. less money. The Portsmouth prospectus, singularly enough, quotes the Journal on electric lighting; but as our remarks which have been so honoured merely refer to what the Rochdale Corporation contemplate doing, they do not advance the question very far as regards Portsmouth.

Lord Crawford, the Chairman of the London Electric Supply Corporation, has been interviewed by the *Pall Mall Gazette*, although one would think that, what with the manufactured excitement over the visit of Edison and the *Daily News* articles, enough had been said for the present about the doings of this Company. At all events, not very much that can be described as novel was extracted from the noble Earl by the persevering newspaper man, except a statement to the effect that the Deptford station is actually working, although in a small way. None of the gigantic plant that has been so much advertised—the dynamos with armatures 42 feet in diameter and shafts 36 inches thick—is ready, or can be for some time. It is not clear, however, what the machinery is really doing at Deptford, for in one place Lord Crawford speaks of something as "working now" at that station, and elsewhere he admits that current has not actually been sent from Deptford to London. Then again he states that the primary current is sent up at a tension of 10,000 volts; but it appears that this is meant to be understood in the future tense. As to doubts and dangers, Lord Crawford merely ignores everything of the kind. Although the pressure his Company propose to work at far surpasses anything hitherto attempted either by them or by anyone else, and although this tremendous current is to be sent through a cable jointed at every 20 feet, he is sublimely confident that everything will go right from the moment the engines are started. We shall see.

The last report on the proposed electric lighting of the City of London, to which reference was made in our columns last week, came up for consideration by the Commissioners of Sewers yesterday. It would not be easy to state succinctly all that the City Fathers have done in this matter of electric lighting, or give a synopsis of the reports they have received respecting it—mostly with no further result. When the subject was previously before the Commissioners, it was made to appear that the Brush Company had it all their own way; but, owing to some uncertainty as to what the Company really offered for the money they asked, the whole thing was referred back to the Streets Committee for further investigation. This much-tried body has finally succeeded in getting the Metropolitan and London Companies into line with the Brush Company. They accordingly reported that they could obtain arc lighting for the City streets for the sum of £26 per lamp per annum; and so they advised the Corporation to enter into contracts on this basis, which means an outlay of close upon £11,000 for 395 arc lamps to take the place of 1730 gas-lamps, costing £5530 per annum. Of course, the Committee said that, although the expense of the new arrangement would be nearly double that of the present method of lighting, the amount of light would be very much greater. This is the old delusion, based on the confounding of theoretical light intensity with actual lighting effect, which has misled so many local authorities. We venture to argue that to replace four gas-lamps by one lamp (whether it be gas or electric), however brilliant, is a mistake from the point of view of utility and comfort. It might as reasonably be argued that the right way to warm St. Paul's Cathedral is to make a big fire under the dome, and try to persuade the people that they ought to feel warmer on account of the vast number of heat-units supplied by such a centre of combustion, compared with the diffusion of heat by hot-air or water pipes. The motion for the adoption of the report was met by an amendment from Mr. Pannell to refer the whole subject back to the Committee for re-consideration; and, after some discussion, this was carried unanimously.

Stoppage of the Electric Light in New York.—According to a telegram received through Reuter's Agency, the streets of New York were in darkness on the night of Monday, the 14th inst., in consequence of the electric light companies having stopped the currents. It is stated that this action is due to a dispute existing between them and the authorities, on account of the dangerous condition of the overhead wires, shocks from which have recently caused some deaths. Until the dispute is settled, other means of lighting the city will have to be employed.

Laying Mains Under Water.—In a recent number of the *Engineering and Building Record*, Mr. E. L. Abbott described a method adopted by him of laying mains under water. The particular case cited to illustrate the plan was that of a 10-inch pipe, 800 feet long, across the St. Joseph River. A double line of posts were set up, and braced by string pieces and cross pieces, which received the pipe. After all the pipes in the section to be laid had been caulked, wooden rollers were set above them, ropes passed under the pipe at each hub, and the ends brought up and fastened to the rollers above, upon which all the slack was wound up. When everything was in readiness, two men were stationed at each roller, and turned it enough to just take up the weight of the pipe. The cross pieces, &c., were knocked off; and the pairs of men, alternately setting their levers in the holes, gradually and uniformly lowered the pipe into position on the river bottom, which had been dredged sufficiently to form a regular bed. One ball-and socket joint was used in the length of pipe. Ten men in ten days time built the scaffold, caulked the pipe, and removed the scaffold after laying; and eighty men in two hours lowered the entire length of pipe complete. The pipe has been laid about eleven years, and has never required attention; nor have any leaks been discovered in it.

MIDLAND GAS MANAGERS AT THE BIRMINGHAM COMPRESSED AIR COMPANY'S WORKS.

The members of the Midland Association of Gas Managers had a pleasant meeting in Birmingham last Thursday. The programme comprised discussions on the papers of Mr. J. Ferguson Bell and Mr. W. T. Tew (both of which were submitted at the preceding meeting at Derby and Matlock), besides a visit to the works of the Birmingham Compressed Air Company, and the usual formalities of an ordinary meeting of a District Association of Gas Managers. It was the occasion for the leave-taking of Mr. Taylor, of Derby, who has filled the presidential chair during the past year with much credit to himself and advantage to the Association. His successor is Mr. H. Peaty, of Burslem—a very popular member, and worthy representative of the Staffordshire section of the Society. Fitting acknowledgment was made, both during the business part of the meeting and at the subsequent dinner, of Mr. Taylor's services; and a hearty reception was accorded to the incoming President. The chief technical subject brought before the members was water gas, raised by Mr. Bell's paper; and although the discussion of the topic was not exhaustive, and indicated clearly enough that practical experience of the working of water gas plant was lacking, it cannot be complained by friends of this kind of gas that the Midland Gas Managers regard it with any sort of prejudice. Mr. Bell, indeed, was very trenchant in his criticisms of water gas schemes, and seemed to think that under no probable circumstances could water gas be of much account in England; but even he did not expressly object to a declaration by Mr. Ellery, that if this description of gas could be made at about the ordinary cost of coal gas, or less, he would not have the slightest objection to adopting it. In fact, several members seemed to think that there might be circumstances where water gas plant would prove useful in an English gas-works, even though it were a little more costly to make. It would not do, however, to allow water gas projectors to flatter themselves, from the manifestation of this tolerant spirit among English gas managers, that the day for the adoption of water gas plant in English gas-works, even as an auxiliary, is within the range of practical gas politics. It is as yet far too costly for anything of the kind. Water gas enthusiasts must not blind themselves to the fact that the gas of 16 or 17 candle power, which English gas companies can sell in places for about 2s. 3d. per 1000 cubic feet, costs in the holder only about 8d. per 1000 cubic feet, which is less than half the cost at which any known system of water gas making can produce an equivalent article. If Russian crude oil is ever piped across from Baku to the Black Sea, and imported into this country by means of tank steamers, it is difficult to see how it can be put into gas-works on shore for less than 3d. per gallon. This is the cheapest source to which we can look for a fluid mineral hydrocarbon suitable for carburetting water gas; and it is difficult to imagine that it can ever be sold in England at the figure named. Even this, however, would not be cheap enough to make carburetted water gas compare favourably, in point of cost, with ordinary coal gas. The prospects of water gas, or cheap fuel gas, distributed uncarburetted for uses other than lighting, received a striking illustration from what the members of the Midland Association saw and heard later at the compressed air works. Before visiting this establishment, however, they discussed Mr. Tew's paper on the effects of temperature in relation to unaccounted-for gas, which brought out several interesting practical observations concerning meters, mains, &c.

The undertaking of the Birmingham Compressed Air Company has been described and discussed several times in the JOURNAL, from the time when the scheme was first propounded and reported upon favourably by Sir F. Bramwell and Mr. Piercy. After much delay, and the overcoming of many difficulties, the scheme has been realized; and at the present day Birmingham counts the compressed air supply among her most noteworthy manufacturing advantages. Although the works are not yet out of the contractors' hands, a shift has been made to get a section of the plant in operation; and the Midland Gas Managers were able to see last Thursday the shape to which the Company have reduced their project, and the lines on which they mean to carry on their enterprise. The mains have been charged, and some consumers supplied for about a year; and nothing now remains but to increase the steam plant at the generating station to keep pace with the hoped-for increase in the demand. The Company have a commodious site for their station, with good railway facilities for the supply of coal, and a canal for other purposes, including convenience with regard to condensing water. The whole future of the Company is pinned to the realization of the idea that it will pay power users in the town better to purchase compressed air delivered through street mains into their engines than to generate steam for themselves. Consequently, the Company have to depend for their profit on the margin they can secure between the cost of generating and distributing power by their machinery and plant and the price which a power-user can be induced to pay them for it. In other words, they must solve the problem whether the generation of power in a large station can be done so cheaply, as compared with small engines, that it can be sold at a profit, notwithstanding the loss of distribution by the medium employed for the purpose—in this case compressed air. Consequently, a visitor to the works of the Company may reasonably expect to see the most efficient steam-power plant that money can buy.

The problems of generation and distribution may be considered, as they have to be solved, separately. A compressed-air company may be supposed to fail, if it fails at all, through defective generating plant or imperfect distributing arrangements; and certainly cannot succeed unless both are perfect. The first necessity is, however, good steam plant. The Birmingham Company propose to employ their capital of £150,000 in generating 6000-horse power, and supplying it throughout the Birmingham district. Half of the steam plant required is being laid down to begin with; and a portion is actually at work. That seen by the Midland Gas Managers consisted of a triple-expansion compound condensing engine, by Fowler, of Leeds, working single-action plunger air-pumps feeding directly into the main, and supplied with steam by three sectional water-tube boilers, fired with gas made in Wilson producers from slack costing on the spot about 6s. per ton. Nothing could well be more elementary, or, in its way, satisfactory. While the scheme was incubating, there were all sorts of refinements talked about—electrical check meters and several other imaginary requirements. These more or less "cobwebby" additions to the simple steam plant have been quietly dropped; and the works are only a steam-power station, worked according to gauges and indicators of the ordinary type. The main engines are after the marine type; and are believed to be almost unique in respect of repeating on land the elements that have proved so successful in economizing steam on board ship. Each set will work up to about 1000-horse power indicated; but at the present time scarcely half this is required. The high-pressure cylinder is supplied with steam at about 140 lbs. per square inch, which is reduced to 45 lbs. in the second cylinder and to 3 lbs. in the last, which chiefly works by virtue of the vacuum. The air is compressed to 45 lbs. per square inch in the mains (there being no accumulator), and this pressure develops at the outset a considerable amount of sensible heat. Theoretically the rise of temperature should be 260° Fahr., but a good deal is very quickly lost; and although the air at its entry into the mains may be at a temperature of 200°, it quickly cools down, depositing water at the same time, so that before it is half a mile from the works, it is at the normal temperature and dry. The duty obtained by the user is about 50 per cent. of the power put into the air at the station; so that of 1000-horse power generated at the station, 500-horse power may be depended upon to re-appear in the consumers' motors, supposing the air to be utilized in this way. There are other applications for the air, of course—such as refrigerating, blowing, &c.—which would, in practice, complicate the problem of ascertaining what becomes of the power generated at the station. At all events, there is a loss of 50 per cent. of energy, due to the medium of distribution, to be compensated for by increased economy of generating plant as compared with ordinary steam machinery.

The engines must supply their share of this economy; and it is probable that no steam-engines in Birmingham of less than 100-horse power, and very few above, show such economy of steam as those of the Compressed Air Company, which are stated to use only 16 lbs. weight of steam per indicated horse power, and are confidently expected to do even better when they are fully loaded and running at their best speed. Next to the engines come the boilers. These, as already mentioned, are after the sectional water-tube pattern, which seems to be making great headway where high-pressure steam is required to be economically produced, to the supersession of the old-fashioned Lancashire boilers. We should like to see some authoritative evidence on this head. There are no means of telling at present how these boilers of the Compressed Air Company compare with the generality of steam generators in the town; but if there is anything in following the fashion, they certainly enjoy it. With regard to the last, and in many ways most important point of this plant—the gas generators—we cannot say that the system adopted shows any conspicuous advantage over any good form of mechanical stoker. The advantage of gasifying the fuel at a distance from the point of utilization, and so losing the radiant power of the solid fuel, as well as that portion of its heating power which escapes during transit through long underground flues, is very doubtful. The idea of employing generators was adopted by the Company's Consulting Engineer (Mr. J. Sturgeon), in order to cope with the conditions of a varying demand on the works. He thought the supply of fuel gas could be checked and increased as required with greater convenience and economy than a direct-acting fire-grate; but whatever may be said for the intention, the Wilson gas producers seem to be scarcely the right things to carry it out. It was stated, among other drawbacks of their use, that they require to be let down cold for clinkering every three days, which must mean a serious loss of heat; and they need constant attention. The success of the Company does not, of course, depend on this or any particular gas producer or mechanical stoker; but they cannot be regarded as in a safe or logical position until they can challenge anybody in the town and district to a comparison of furnace and boiler efficiency.

The Midland Gas Managers had no time to inspect any of the factories where the compressed air power is in use; but they saw, on the works, a small engine driven by it, and heard an account of the uses to which it is applied. There is not much to be said concerning the distribution arrangements. The mains are of wrought iron or steel, without flanges or sockets and spigots; being jointed by means of sleeve-pieces, or double socket rings, leaded on both sides. These make a perfectly tight joint, and there is an expansion joint made with an india-rubber ring at about every twelfth length. The thickness of the pipe is not sufficient to allow services to be tapped in, in the ordinary way; and therefore junctions are provided at intervals, fitted with valves, which allow connections

to be made without interfering with the pipe or stopping the service. Consumers are supplied through meters designed, on the principle of the turbine, by Mr. Abrahams, the Resident Engineer, which appear to be more satisfactory in action than anything else of the same kind which the Company have been able to procure.

The visitors were received by Mr. Sturgeon, the Consulting Engineer, who attended specially for the purpose, and were shown round the establishment by Mr. Sturgeon and Mr. Abrahams; these gentlemen being most assiduous in their attentions, and untiring in answering queries and giving information. A well-deserved vote of thanks to the Directors and officers of the Company was tendered by the President of the Association, and fittingly responded to. The visitors carried away with them a high appreciation of the thoroughness with which the Compressed Air Company have set themselves to carry out their undertaking, as well as a favourable impression regarding the future which appears to lie before the application of compressed air to industrial and social purposes. The driving of engines in factories by this agency means not only economy in many instances, but also cleanliness, safety, and deliverance from smoke and damp steam. It also means improved ventilation and cooling of crowded work-rooms; thus adding to the comfort and conducing to the health and happiness of the operatives. Shops, theatres, warerooms, and churches, to say nothing of private houses, can be efficiently ventilated when a supply of compressed air is available; and if the Methven-Sugg system of gas lighting is to flourish anywhere, it should be in Birmingham. It is even possible something altogether fresh may be done in the way of burning gas under pressure of air. Many other uses of the Compressed Air Company's product might be named; but we are not concerned to state the probable extent of their operations. Suffice it to say that their scheme, and the manner in which they are carrying it out, are worthy of the attention of all engineers, especially those who are interested in power distribution.

Presentation to Mr. R. Pierson.—On Thursday, the 10th inst., the workmen in the employment of Messrs. W. Sugg and Co., Limited, met at the Ship Hotel, Vauxhall Road, and presented to Mr. R. Pierson a handsome timepiece and illuminated address, as a mark of their esteem and respect, on his retirement from the firm after 23 years' service.

Asphalte Pavements Injured by Escaping Gas.—In a recent issue of the *Centralblatt der Bauverwaltung*, attention is directed to the fact, observed in some of the streets of Frankfort-on-the-Main, that the asphalte pavement in the immediate neighbourhood of large gas-mains is rapidly destroyed by escaping gas; deep cracks being formed. This has been found to be particularly marked at places where the underlying layer of concrete was imperfect, due to interruption of the work overnight while laying. If this is true, it furnishes, says the *Engineering and Building Record*, an additional reason for preventing that escape of gas from the mains in New York City which has already given so much trouble by explosions in subways and sewers.

The Conference on the New Railway Rates.—The conference which has been arranged by the Board of Trade between the representatives of the railway companies and the various traders and others interested in the settlement of a schedule of rates for the carriage of goods under the Railway and Canal Traffic Act, 1888, was opened last Tuesday in the Town Hall, Westminster, under the presidency of Lord Balfour of Burleigh. There was a full attendance of Counsel representing the various parties; the number of objections to the rates being very large. The business done was simply the arrangement of preliminaries; after which there was an adjournment for a fortnight. The future meetings will be held on Tuesdays, Wednesdays, and Thursdays in each week until the close of the inquiry.

Sale of Stock in the South Metropolitan Gas Company.—On Friday last, at the Auction Mart, Tokenhouse Yard, Mr. G. A. Wilkinson offered for sale £50,000 of 5 per cent. perpetual debenture stock in the South Metropolitan Gas Company. The bidding began briskly; but before many lots had been sold, the Auctioneer was obliged to admit the prices were not reaching the reserve, which he mentioned was £136 per £100 stock. A few lots were then bought at this figure; but nearly two-thirds of the stock had to be withdrawn, as it failed to realize the reserve price. The following prices were obtained for the lots which were sold:—£1000 sold for £140 per £100; £5000, for £139 10s.; £1000, for £138 10s.; £1000, for £138 5s.; £1000, for £138; £500, for £137 5s.; £1500, for £137; £500, for £136 10s.; £1000, for £136 5s.; £5900, for £136.

The Smoke Abatement Question in the Metropolis.—At the meeting of the London County Council last Tuesday, the Sanitary and Special Purposes Committee reported, on the subject of a reference to them last summer of the question of the causes of London fogs and the best means of removing them, that they had come to the conclusion that it was impossible to propose any practical suggestion for dealing with the difficulty. The discussions and investigations on the subject which had taken place during the past few years had not, they said, disclosed any method of prevention which promised to effect any material abatement of the evil. There was little difference of opinion as to the extent and gravity of the injury caused in London by fog; and the Committee expressed their willingness to consider any suggestion of a practical nature which would enable the Council to take effective measures for abating the evil.

CHEMISTRY FOR ENGINEERS.

Although the handy volume recently published by Mr. Vivian B. Lewes* is compiled primarily for the benefit of students in training for the scientific branches of the naval and military services, it contains so much matter calculated to be useful to civil engineers, that we have thought fit to give it a wider designation than that chosen by the author. The name of the book is nevertheless a very happy one. It means, if it means anything at all, that the matter contained in its pages is of the hardest and sternest practicality, and that the author wrote with a full knowledge that more than experimental success—perhaps human life itself—depended upon the accuracy of his definitions and teaching. It may be asked, however, what we have to do with chemistry as taught to young naval or military officers; and, indeed, the connection is not very apparent at the outset. Upon turning over the pages, however, we perceived such headings as "Coal Gas," "Coal Tar Products," "The Illuminating Power of Flames," "Coke," &c.; and these warned us that Mr. Lewes's work might have special interest for our readers. When it is remembered, moreover, that many of Mr. Lewes's pupils in the present will have in the future to look after the physical well-being of many thousands of men in barracks, both at home and abroad, it becomes evident how necessary it is for them to be well grounded in all matters relating to lighting, warming, ventilation, and water supply. Taking the last subject first—for so it happens to come in Mr. Lewes's pages—we find him explaining clearly and simply the nature and origin of the various impurities of drinking water, and the means whereby these may be removed. There are certainly many references to the water supply of the "house," and to the "companies," in this chapter, which looks as if Mr. Lewes did not write everything from the purely service standpoint. This, of course, makes his remarks more interesting to the civilian world; while the fact that he does not forget the different requirements of military and naval life, adds a pleasant flavour of specialism to his matter. There is a valuable chapter on boiler incrustations and their prevention, in the course of which the author speaks favourably of the use of paraffin oil for this purpose.

In treating of coal gas, Mr. Lewes commences at the beginning with the carbonizing plant; explaining the process of distilling coal in retorts, the outlet pipes of which are sealed in a hydraulic main, which arrangement he describes as necessary in case one of the retorts should crack, when it would prevent the gas from the other retorts from coming down the pipe. It might have been added that the hydraulic main also permits the retort-lid to be taken off when the charge is exhausted, without risk of escape of gas from the other retorts, which would have been a simpler reason for the hydraulic main than that which Mr. Lewes has cited. Mr. Lewes's account of gas purification also savours more of the laboratory than the gas-works; but his description of gas-burners and gas-flames generally is unexceptionable. He holds sound views, moreover, concerning the comparative advantages of liquid, solid, and gaseous fuels. Ventilation receives a tolerably long and full discussion in a special chapter, in which the effects of gas and other illuminants in vitiating the atmosphere of living-rooms are authoritatively explained. Building stones and cements are treated by Mr. Lewes in a style of what may be called broad chemistry; the distinction between the chemical and the physical and practical aspects of his subject being hardly perceptible. There is much more in the book which we cannot find space to mention. It concludes with a number of questions designed to test the student's comprehension of its contents, besides several appendices (giving useful data), and a copious index. Altogether, it is one of the most practically-written manuals on the subject of which it treats that we have lately had the pleasure of looking into; and we have no hesitation in recommending it to students of chemistry and engineering, whether in or out of the service. It is well and clearly printed, with many illustrations of commendably modern aspect, and neatly bound.

AMMONIA AND AMMONIUM COMPOUNDS.†

The voluminous title given to this small work of 120 pages is perhaps necessary in order to distinguish it among the numerous works dealing with the same subject, that are now before the public. But the plan of including a considerable portion of the preface in the title is not to be recommended as a desirable precedent. We demur to the statement on the title-page, "Illustrated by numerous woodcuts," as being rather a high-flown description of the nine engravings, some of an insignificant and indifferent character, that are to be found throughout the book; and also to the title of "practical manual," as being scarcely borne out by the nature of the contents, which are chiefly of a text-book character. The preface consists of an extension of the

* "Service Chemistry; being a Short Manual of Chemistry and its Applications in the Naval and Military Services." By Vivian B. Lewes, F.I.C., F.C.S., Professor of Chemistry at the Royal Naval College, Greenwich, &c. London: W. B. Whittingham and Co.; 1889.

† "Ammonia and Ammonium Compounds—comprising their Manufacture from Gas Liquor and from Spent Oxide (with the Recovery from the latter of the Bye-Products, Sulphur, Sulphocyanides, Prussian Blue, &c.); special attention being given to the Analysis, Properties, and Treatment of Raw Materials and Final Products. A Practical Manual for Manufacturers, Chemists, Gas Engineers, and Drysalters. From personal experience, and including the most recent discoveries and improvements." By Dr. R. Arnold. Translated from the German by Harold G. Colman, Ph D., M.Sc. London: Sampson Low, Marston, Searle, and Rivington, Limited; 1889.

title, with the further information that the book may be regarded as an attempt to collect descriptions of all the processes necessary for the utilization of the nitrogen present in coal. If it is complete in this respect, we can only say that the processes in question are very few in number. After a brief introduction, there is a fairly complete notice of the various ammonium compounds at present known or applied in a commercial sense, their respective properties, &c. The detection and estimation of ammonia are disposed of in five pages, by a description of the distillation test, and the azotometric method, together with instructions for the preparation of standard solutions and reagents. We then come to the manufacture of ammonium sulphate, liquor ammoniæ, ammonium chloride, carbonate, chromate, oxalate, &c., with a few remarks on the disposal of waste gases, lime mud, and spent liquor. The chemical nature of the reactions involved in the removal of sulphuretted hydrogen from coal gas by means of oxide, and the subsequent revivification of the material are passed in review; also the treatment of the spent oxide for the recovery of thiocyanates, ferrocyanides, and sulphur. There is an appendix, comprising several useful tables; also a list of recent literature and patents having reference to the subject of ammonia.

As to the value of the book to gas engineers, they will not find much new matter in respect to the use of oxide or the manufacture of sulphate. It will be useless for them to search therein for information on the much-discussed subject of how to make white sulphate from pyrites acid, or how to dispose of the waste gases from their sulphate works. Those who are not possessors of standard books of reference on chemical subjects, however, will find a great deal of useful chemical information, relating to the properties of acids, ammoniacal liquors, and compounds, the practical analysis and testing thereof for impurities, and especially in regard to what may be termed the lesser-known compounds of ammonium.

It is announced that Mr. Carl van Beck and Mr. C. Rumping have resigned their seats on the Board of the Johannesburg Water-Works, Estate, and Exploration Company, Limited.

The offices of Stapp's Water Gas Patents, Limited, have been removed from No. 120, Cannon Street, to No. 16, St. Helen's Place, E.C.; and Mr. L. C. Farebrother has been appointed Secretary of the Company.

The gold medal of the Cologne International Exhibition has been awarded to the "Shaw" gas governor, which has also gained the "James Watt" silver medal of the Royal Cornwall Polytechnic Society—the highest award made by that Society.

The return made by Mr. W. J. Dibdin to the London County Council, on the quality of the gas supplied in the Metropolis during the week ending the 12th inst., contains only one record of the illuminating power being below the standard, and that was at the Peckham station of the South Metropolitan Company, on the 10th inst., when it was found to be 15·7 candles.

Under the title of the Midland Engineering Company, Limited, a joint-stock company has been registered with a capital of £100,000 in £5 shares, with the object of purchasing the manufacturing rights of the "Beck" gas-engine for the United Kingdom, India, Victoria, South Australia, Queensland, New South Wales, and elsewhere, to purchase certain other machinery patents, and to acquire the freehold property and works known as the Sandiacre Engine Works, near Nottingham.

By the death of James Prescott Joule, which took place at Sale, near Manchester, on Friday, the 11th inst., in his 71st year, after a long period of ill-health, Science has lost one of her great original workers, whose name will be for all time associated with the discovery of the mechanical equivalent of heat. In his youth, Joule studied chemistry under Dalton, the propounder of the atomic theory; and he seems to have been early inspired with enthusiasm for scientific research. His studies gradually brought him into what fifty years ago was an entirely new department of science—thermo-dynamics—in which so much good work has since been done. He had been speculating on the conversion of chemical energy into heat, and between 1840 and 1842 he gave accounts of a number of experiments, all leading up to his great discovery. This, in its earliest form, was first announced at the Cork meeting of the British Association in 1843, in a paper on "The Calorific Effects of Magneto-Electricity, and on the Mechanical Value of Heat." In the course of that paper he stated that his experiments had satisfied him that "the grand agents of Nature are, by the Creator's fiat, indestructible; and that, whatever mechanical force is expended, an exact equivalent of heat is always obtained." He continued to work at his discovery, and eventually, in a paper presented to the Royal Society in 1878, he gave the results of a fresh determination, according to which the quantity of work required to be expended in order to raise the temperature of 1 lb. of water, weighed in vacuum, from 60° to 61° Fahr., is 772·55 foot-pounds, at the sea-level and in the latitude of Greenwich. Joule's experiment has been repeated by many hands, in many forms, and on great scales; but nothing has shaken the truth of his conclusions. The practical results which have accrued from his discovery have been of the most useful kind, as they have enabled engineers to improve their machinery along lines of precision not otherwise attainable. The love of scientific investigation which had chararterized his life existed till near its close. In 1878, he received from Her Majesty a pension of £200 a year, on which he lived in quiet retirement.

Notes.

Asbestos Sealing for Retort Lids.

To the various methods now in use for fastening the lids of retorts without luting, M. Laurain, of the Troyes Gas-Works, has added another, which he described to the members of the Société Technique du Gaz en France at their last meeting, and which was briefly alluded to in the general notice of the papers read on that occasion, contained in the Journal for July 23 last. In the mouthpiece of the retort, there is formed a channel about ¾ inch deep, which is filled with asbestos, forced into the recess with sufficient firmness to enable it to retain its position without any further fixing. This material, being elastic, yields to the pressure of the lid, the mere closing and fastening of which effectually seal the retort, without the employment of so much force as is generally brought to bear in the performance of these operations. In order that the strand of asbestos may be protected from the action of the condensed products resulting from the carbonization of the coal, the channel containing it is formed about ½ inch from the front of the mouthpiece. In addition to this, the lid has on its inner side a grooved rib, the upper edge of which rests upon the asbestos, while the lower one projects slightly into the retort, thus preventing the access of the products to the asbestos, and conveying them back into the retort. If they reached it, however, it would not interfere with the soundness of the joint, which is ensured by the penetration of the rib into the asbestos. But in the event of a deposition of tar taking place thereon, it may be easily got rid of by removing the asbestos, and submitting it to the action of fire.

The Woodbury-Merrill Hot-Air Engine.

A new style of hot-air engine, to be worked by coke, is described in the *American Engineer*. It is constructed with two power cylinders, and two cylinders called reversers. Each reverser is provided with a reverser-heater (placed within a furnace), a regenerator of wire cloth, and a cooler. The principle of the machine is the utilization of the power rendered available by the alternate expansion through heating and contraction through cooling of the same mass of air contained within the reversers. Consequently there are no admission and exhaust valves as in a steam-engine. The machines are constructed of considerable size; some tests being published of an engine indicating 31·18-horse power, which is greatly in excess of the power of any hot-air engine previously built. While the indicated horse power was 31·18, however, the average brake horse power was 19·92. Nothing but gas coke was used for fuel; the consumption for a 10-hours' run, beginning with everything cold, being after the rate of 1·91 lbs. per indicated horse power, and 2·37 lbs. per brake horse power, per hour. During the same test, for a period of 6¼ hours after the engine had attained its normal working condition, the consumption of coke was after the rate of 1·54 lbs. per indicated horse power, and 2·37 lbs. per brake horse power, per hour. The water passing through the coolers on this occasion was supplied at a temperature of 36°, and was discharged at a temperature of 102·8°. This is not regarded as the best the engine can do, as the hot cylinders were not lagged in any way, and consequently a good deal of heat was probably lost. At the same time, the test showed that the class of cheap and safe motors has received an important addition, gas coke another outlet, and the gas-engine another rival. The inventors of this engine are Messrs. J. A. Woodbury, Joshua Merrill, George Patten, and E. F. Woodbury, of Boston, some of whom have been engaged in endeavouring to perfect a hot-air motor for the last 35 years.

The Metric System in Chemistry and Engineering.

The question why modern chemists use the metric system of weights and measures, and why engineers show so little inclination to adopt the same system, notwithstanding the initiative of a sprinkling of college professors, is discussed by Dr. William Harkness, President of the Philosophical Society of Washington. He remarks that in some departments of science, and especially in chemistry, a simple relation between the unit of length (which determines volume), the unit of mass, and the unit of specific gravity is of prime importance. The metric system has this relation, and accordingly it is adopted. To engineers such relations are of small moment, and consequently among English engineers the metric system is making no progress, while the chemists have eagerly welcomed it. The English foot and pound are quite as convenient to engineers as the kilogramme and metre are to chemists; indeed, they are more convenient practically than the metric units. The foot-rule compares favourably, from the point of view of the mechanic, with the metre measure; and the pound is handier than the kilogramme. In gas manufacture it is by no means clear that anything would be gained by computing carbonizing work in cubic metres per hectolitre instead of in cubic feet per ton, which is the English practice, or cubic feet per pound, as preferred by American engineers. It must be conceded to the metric system, however, that it lends itself to a simpler nomenclature for compound expressions than does the English system.

On the *agenda* for the meeting of the London County Council today, there is a notice of motion by Mr. Lloyd, to refer to the Highways Committee the question of the desirability of the Council applying to Parliament for power to improve the condition of the Whitechapel district; and, pending the production and adoption of some complete scheme for the purpose, to light the district with the electric light.

Communicated Articles.

THE DIFFICULTIES OF CONDUCTING ENTERPRISES IN SOUTH AMERICA, ESPECIALLY AS REGARDS BRAZIL.

By "Brasileiro."

Considerable attention is being drawn just now to the above question; and it is well merited, as European, and especially British, capital is very largely invested in the Southern Continent. Almost each of the States into which it is divided has come into the market as a borrower; and the result has been the same in almost every instance. With the exceptions of Brazilian and Chilian securities, every one is at a discount (many of them heavily so); and some of them are practically worthless.

The Times and the *Economist* have recently pointed out that even Brazilian investors, who have hitherto been paid their interest with commendable regularity, have not been without cause for complaint; and the *Economist* goes so far as to impute wilful violation of contract. It is difficult to see how such a charge can be repudiated when the circumstances are taken into account. The Empire has various outstanding 5 per cent. loans, which were to be redeemed by a 1 per cent. sinking fund, to be employed by half-yearly drawings when the bonds were selling above par, or by purchases in the market when the price was below par; thus making a definite period of about 37 years. The Brazilian Government has now decided to issue a new 4 per cent. loan, and to redeem the existing loans at once, unless the holders will consent to convert upon the terms offered. These may, or may not be equitable to the existing holders; but, so far as interest is concerned, a distinct undertaking is none the less violated by one party without the consent of the other. As the *Economist* says: "In view of this present breach of faith, what reliance can be placed upon the clause in the prospectus of the new loan by which the Government undertakes not to increase the sinking fund before the expiration of 20 years?" *The Times* makes this the occasion of a much-needed caution as to the treatment awarded by the Brazilian Government to "individuals or corporations with whom he has entered into business relations." *The Times* says:

> It is no secret that of late years the attitude of the Brazilian Government has not been in all respects satisfactory to all concerned; and we have reason to believe that strong remonstrances have been addressed by persons of weight to the Brazilian Government in regard thereto. The complaints made are that contracts entered into by the Government for the execution of public works, and for managing them when completed, are not in all cases observed by the Government; and we are of opinion that after due allowance has been made for the exaggerations with which people with a grievance usually state their case, these complaints are not without foundation.

The "complaints" referred to have not been confined to Brazil, as traders and companies in all the various States of South America have found it difficult at times to obtain redress for wrongs or to maintain their rights. Owing, however, to the magnitude of the transactions with Brazil, it has necessarily happened that difficulties have been of most frequent recurrence. England has often been spoken of as the "moneyed partner" of Brazil; and it is estimated that the English capital at stake in the Empire is not less than fifty millions sterling, invested in railways, tramways, water and gas supply, drainage, sugar refineries, telegraphs, shipping, &c. All these are useful undertakings, tending to develop the material wealth as well as to promote the happiness and well-being of the country. Very few of these enterprises, however, have escaped without some dispute with the Government as to the terms of their concessions.

The questions of duties and taxation have formed numerous dissensions and many of the complaints referred to by *The Times*. A number of the concessions, notably for gas undertakings, have been obtained from Provincial Governments, who have no power under the Constitution to impose or to remit taxation by means of customs duties, but have solicited and obtained exemption from the Imperial Government. Notwithstanding this exemption, however, duties have in many cases been levied, and only returned after long and costly attempts; while in some cases the exemption has not been maintained. Even where it has been admitted, by refunding the money, that the claim was just, no interest has been allowed. In several cases, the provinces themselves have unconstitutionally levied import duties; and collected them, not only from the general importer, but also from the very companies on whose behalf they had obtained exemption from the Imperial Government. In Mr. Wyndham's excellent Consular Report, No. 504, dated Feb. 19 last, it is stated (p. 22) that "the province of Sergipe has created an import of 200 reis (5½d.) per ton on sailing ships and steamers entering its ports." The province of Pernambuco, on Aug. 11, 1885, imposed a 3 per cent. import duty on the officially declared values of imports, under the name of *gyro commercial*, which is still collected. In the Budget of this year, the Parana Assembly voted an import duty of 3 per cent., which, however, the President refused to sign.

When it is remembered that almost every article of import is heavily taxed, and that the prices of water, gas, &c., are fixed by the concessions, it is clear that these impositions bear more heavily upon them than upon the rest of the traders of the country, who can and must increase their prices to cover the extra cost of duties. The same difficulty has been met with in respect to the taxation levied by the Provincial or Municipal Authorities, who have even gone so far as to impose special taxes on particular companies.

Gas companies have been specially unfortunate in their experience in Brazil; and your pages have borne testimony to their complaints in the speeches addressed from time to time by chairmen to their shareholders, as well as in various reports. Their concessions have usually been granted by the Provincial Governments, who seem to be less amenable to public opinion than the Imperial Government, and whose financial exigencies are apparently greater. The difficulties as to import duties have, of course, been chiefly with the Imperial Government. But complaints have been rife that the Provincial Governments have unduly imposed taxes and fines for bad lights, without sufficient cause; that payments have been made in depreciated currency; and that long arrears have been allowed to exist in public lighting accounts, and when payment has been made it has not been in "gold or its equivalent," nor even in currency, but in bonds, the realization of which involves expense and loss. One company's accounts show an amount of "fines" equal to 15 per cent. of the cost of the public lighting; another has been compelled to receive payment for private lighting and public establishments in currency, although it is specifically agreed in the concession that payments shall be made in gold. As currency has been for many years, until lately, at a discount of from 45 per cent. upwards, the loss under this head must have been enormous. One company complains of arrears of public lighting of more than a year; another has at one time upwards of £20,000 worth of bonds in its possession; and of a third, whose accounts are not available one learns from correspondence in the local Brazilian press, that three years' arrears of public lighting are now owing. Nor is the new Belgian Company exempt from these troubles. From the *Rio News* we learn that during the present year fines of $200 a day (£22 5s.) have been imposed for inadequate stock of coals, and $1000 a day (£111) for insufficient lighting.

It is not easy to see what remedy exists for grievances against the Governments, Imperial or Provincial. It is useless to appeal to the ordinary Courts of Law, as they cannot hear the case. If excessive duties have been charged, or duties levied upon goods which are "duty free;" if taxes have been imposed in an unjust manner, or fines levied without just cause; if property has been seized by any Government authority—in fact, it may be said generally that in no case whatever can the judicial authority take any cognizance as to whether the Executive has acted rightly or wrongly, legally or illegally, constitutionally or otherwise. From a decision given in May last year by the Council of State, and imperially sanctioned in December, it appears that even a municipality is free from the effects of a judicial decision. It is true that the Council of State can annul acts of the Executive, when incompetence, abuse of power, and violation of positive law or formalities exist. This, however, is a very slow and uncertain process; and if the Council should be divided, the decision of the minority may be sanctioned. This actually occurred in November last year, when, four Judges having decided against the Government and two in their favour, an Imperial decree accepted the decision of the minority, which thus became law. Messrs. Monhard and Huber, of Pernambuco, were more successful in their appeal to this Council, as a unanimous decision in their favour was sanctioned; but the process took nearly 3½ years to obtain.

As the decisions of the Treasury and Minister of Finance appear to be the only means of obtaining justice, the formation of a healthy and well-informed public opinion among European capitalists and lenders would seem to be needed as a powerful incentive to fair and honourable dealing with those who have invested their money in the country. Constant applications are being made for capital; and hitherto these have been responded to—thanks, mainly, to the promptitude with which the interest has been paid. There is, however, some cause for apprehension as to the financial prospects of the country. Every year the deficits become greater, both in the Imperial and Provincial budgets; and several of the latter have come into the market for loans. The Provincial debts are already, in some cases, very large. For example, that of Rio de Janeiro is nearly £900,000; Pernambuco, almost the same amount; Minas Geraes, £650,000; Bahia, £600,000; with smaller amounts in other provinces. These are "funded debts" merely; and do not include unfunded liabilities, which are in some cases very considerable. Loans of £800,000 each were placed last year by Bahia and San Paulo.

It will be seen from the foregoing statement, that the anxieties and difficulties of the management of undertakings in Brazil, outside those which are incident to the ordinary course of business, are very great; but it is to be hoped that more consideration will be shown by the Governments than has hitherto been the case. So far as gas companies are concerned, they are, I believe, well and honourably managed, with every desire on the part of their promoters to fulfil, and more than fulfil, the conditions of their contracts. The financial results have, in most cases, been far from satisfactory; and much less so than they would have been had equal consideration been shown to them.

THE CHEMISTRY OF ILLUMINATING GAS.

By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S.

XXX.

Another form of wood refuse that has attracted attention is the spent oak bark, or tan, of which large quantities are continually turned out as a waste product in the manufacture of leather. There is something very fascinating, both to inventors and speculators, in the idea of getting something out of that which is to be had for nothing. In 1863, a "Tan-Gas and Charcoal Company" was formed, with the object of utilizing the waste bark, of which it was said that there were accumulations of hundreds of thousands

of tons in Bermondsey, with a weekly addition thereto of 800 loads.* This was to be converted, by the medium of a process patented by Mr. W. Lorberg, into charcoal, sulphate of ammonia, acetate of soda, naphtha, tar, and illuminating gas. According to the average results of a "vast number of experiments," the aggregate value of these products per ton of material treated was £2 2s.; and the expenses of working would not exceed 10s., leaving a net profit of £1 12s. per ton. It was proposed to limit the scale of operations, in the first place, to 150 tons per week; and this, according to the foregoing calculations, would yield a profit of about £12,000 per annum, on the capital of £20,000. The gas was to be sold in bulk to a neighbouring gas company for 1s. per 1000 cubic feet. Lorberg's process is described in two patents, No. 650 of 1861, and No. 2187 of 1863. These cover the destructive distillation of all kinds of woody fibres; and the form of retort recommended is an ordinary "double" horizontal, of ⊓ section, about 16 feet long, fitted with lids at both ends, and an exit-pipe at one end only. A charge is introduced at the opposite end; and when it is about half worked off, is pushed forwards, and a fresh one introduced. When the second charge is half worked, the first will be exhausted. The residual charcoal is drawn out at the end adjoining the exit pipe, the second charge pushed forward, and a third one introduced. This is continued, so that the retort always contains two charges in different stages of carbonization; and the gas from the fresh charge passes over the nearly exhausted previous charge before leaving the retort. A result of the publication of these particulars in the JOURNAL, was a short account of some experiments on tan, conducted by Mr. W. King, of Liverpool.† This gentleman found, after several experiments, that the average yield per ton of tan, thoroughly dried at 212° before being placed in the retort, was 12,000 cubic feet of very poor gas (only 4-candle), and 5½ cwt. of charcoal. The crude gas contained 23 per cent. of impurities, probably carbonic acid; and after purification by lime it was found to contain 5½ per cent. of matters absorbable by bromine, and 33 per cent. of carbonic oxide. The tan yielded a very large quantity of water—about one-third of its entire weight—and scarcely any tar. The water showed a very feeble alkaline reaction; and the charcoal was worthless as fuel. The correctness of Mr. King's results is supported by the fact that the Company had a very short and chequered existence.

Probably the chief source of anything in the way of illuminating gas from wood, is the resin present in that substance. A great deal of attention has been directed, from time to time, to the use of resin as a gas-making material. The subject was fully considered in a very early number of the JOURNAL,‡ where it is stated that Professor Daniell had constructed an apparatus capable of producing 9 cubic feet of 28-candle gas per pound of resin. Comparing this figure with that obtaining in the case of coal, it is shown that one ton of coal would yield 9250 cubic feet of gas, the net cost of which would be 10½d. per 1000 cubic feet; but the net cost of producing a corresponding lighting value from resin would be 2s. 2½d. It is very pertinently remarked that resin approximates very closely in chemical composition to Scotch cannel; but as resin costs about £3 per ton, the latter must obviously be the cheaper material. Dealing with the possibility of diluting the rich resin gas by means of water gas, some authoritative experiments made by means of White's process are quoted, which go to show that the cost, light for light, would be greater than that of the pure resin gas, and not less. The cost of producing a value equivalent to that of the coal gas above mentioned would be 2s. 10½d., or more than three times as much.

The question of water and resin gas was investigated by Dr. Fyfe,§ who gives the results of several experiments, as well as an elaborate consideration of the gas-producing properties of resin, either by itself or in combination with the water gas process. The best result he could obtain from resin was nearly 10 cubic feet of gas per pound, specific gravity ·640, containing 10 per cent. of carbonic acid, and in illuminating value about equal to ordinary coal gas. If the large proportion of carbonic acid had been removed, the quality of the gas would have been very high.

In the early days of gas lighting, several companies were formed for the purpose of supplying gas produced from resin, according to the plan devised by Professor Daniell, above alluded to. A horizontal retort, charged with fragments of coke, was used. The resin was fed into a tank on the top of the setting, where the heat was sufficient to reduce it to the fluid state. This object was further assisted by returning the oil deposited by the crude gas into the tank. The melted resin flowed through a wire-gauze strainer to a syphon tube, by which it was introduced into the front part of the retort in regulated quantity. The exit pipe was situated at the back of the retort, and was made very short and large in diameter. It communicated with a large rectangular tank or cooler, surrounded by a refrigerator, in which a large quantity of oil was deposited. From this the gas was conveyed by a long perpendicular pipe to a second condensing chamber, where a further quantity of oil was deposited. Syphon overflow pipes conveyed the oil to a suitable storeage tank. The retort was kept at a bright-red heat; and it was said that each hundredweight of resin yielded 1000 to 1200 cubic feet of very rich gas, of which 2 cubic feet would go as far in light-yielding power as 5 cubic feet of ordinary coal gas. It is scarcely necessary to add that in every case the resin was soon abandoned in favour of coal.

Mr. Alexander Wright presented a report on a scheme for manufacturing gas from resin oil in 1850, which will be found *in extenso* in the JOURNAL.* The promoters of this were manufacturers of "camphine" from resin, in the course of which large quantities of a residual oil were left; and this resin oil was the material that was brought forward under the attractive title of "vegetable" oil, as a cheap source of high quality gas. Mr. Wright found that the best results obtainable from the oil were 100 cubic feet of gas per gallon, specific gravity ·850, and about 50-candle power. There was a loss of nearly 3 lbs. per gallon of oil, as the oil would weigh about 9 lbs. and the gas yielded not much over 6 lbs. Of this, 2 lbs. of soot or carbon were deposited in the retort; the remainder being ascribed to unobserved leakage or deposit. The cost of producing 100 cubic feet per day for one year, is estimated at £88 12s., with oil at 2s. per gallon; and this is equivalent to a cost of 48s. per 1000 cubic feet, or taking quality into consideration, to coal gas at 12s. per 1000 cubic feet. If a larger quantity was required, the cost might be reduced to 38s.—equivalent to coal gas at 9s. 6d. per 1000 cubic feet.

The paper read by Mr. Henry Gore at the meeting of the British Association of Gas Managers in 1873, which has been mentioned in connection with wood gas, also affords some information respecting resin gas. Mr. Gore considers that the only circumstances under which resin can be used on the commercial scale, with advantage, are where it is cheap as compared with coal. In practice only about one-half of the resin is converted into gas; the remainder being condensed as oil. He gives as an average yield, 18,000 cubic feet of 14-candle gas per ton of resin. It would appear that the specific gravity of this gas must be very high—about ·800, which may be due to the presence of a large proportion of carbonic acid, which would also account for the poor quality of the gas. Mr. Gore points out a curious property of resin gas. In its pure form it may be distributed with facility; but if mixed with other gases, a thick viscid deposit is formed upon the interior of pipes or fittings through which the mixed gases may have passed. This may have something to do with the practical failure of White's and other processes in which resin gas was used as an enriching material; but the chief practical objection appears to be the large proportion of carbonic acid present in the gas.

The various minerals which represent connecting links between wood and coal, such as the numerous varieties of peat, lignite, and shale, are all capable of yielding illuminating gas when exposed to destructive distillation. Like resin and wood, however, they are not so convenient in use as coal, and the possibility of turning them to account in a commercial sense, depends upon their quality and comparative freedom from earthy and other impurities, as well as upon their market value as compared with coal. Like wood, peat always contains a large quantity of moisture, which can only be displaced by a considerable outlay for fuel. It has been turned to useful account, however, in France, Russia, and other parts of the world. The prospectus of the West of England Compressed Peat Company, issued in 1878, set forth that when properly carbonized, peat would yield 11,000 cubic feet of 22½-candle gas per ton;† and a large number of experiments made in Russia fully supported that statement. It was then suggested that peat might be able to compete with low-class cannels; but it has never done so to any noticeable extent.

An article on "The Peat Workings of Northern France," by M. Colard,‡ gives a great deal of information as to the practical utilization of this substance. It is stated that the peat, after stacking under cover for a year, still contained not less than 25 per cent. of moisture; and that the cost of heating the peat and the removal of lumps of earthy impurity, pressing into briquettes, and drying, is about 13s. per ton. But if a large quantity was treated, this figure would be much lower. The dried peat yields about 6 per cent. by weight of tar (the quality of which is excellent) and 14,000 cubic feet of gas per ton. The quality of the gas is about 20-candle before, and 28 candles after purification; the improvement in quality being probably due to the removal of carbonic acid. A later article on the same subject,§ states that peat contains much water and earthy impurities, is capable of producing gas more or less freely, and that the crude gas contains an almost unmanagable quantity of carbonic acid. When subjected to distillation, it yields a gas of feeble illuminating power, and an oily liquid from which a gas of 60 to 80 candle power can be obtained. But the mixture of these two gases is only of about 10-candle quality; and 1000 parts of peat yield 400 parts of charcoal, 350 of ammoniacal liquor, 50 of tar, and 200 of gas and loss.

ROLLING LIQUID METAL.—Among the most interesting and successful of recent inventions is a rolling-mill for producing sheet metal direct from the molten state, instead of rolling it from a billet or bar. A machine of this character has been at work for several months at a can factory in Maywood, near Chicago. It is used for making sheet solder, 6 or 8 inches wide, and 0·015 inch thick, which it produces at the rate of 400 feet a minute. The apparatus consists of hollow rolls with cold water running through them. The water is introduced through the axles, and the rolls are of sufficient size to at once change the jet of melted metal into solid form as fast as it is fed. The powerful compression exerted by the rolls on the molten metal in forcing it between the two surfaces, and at the same time changing it to a solid body, tends to give to the sheet an even and highly-finished surface.

* See JOURNAL, Vol. XII., p. 628.
† *Ibid.*, p. 656.
‡ See Vol. I., p. 113.
§ *Ibid.*, p. 222.

* See JOURNAL, Vol. II., p. 394.
† *Ibid.*, Vol. XXXII., p. 86.
‡ *Ibid.*, Vol. XXXVIII., p. 119.
§ *Ibid.*, Vol. XLII., p. 675.

Technical Record.

THE ENERGY-RELATIONS OF GAS AND ELECTRIC LIGHTING.

A recent issue of the *Stevens Indicator* contained an article bearing the above title by Dr. Henry Morton, Professor of Chemistry in the Stevens Institute, Hoboken (N.Y.), the main portions of which it may be of interest to reproduce.

The author begins by remarking that during the past ten years most of the brightest minds among inventors have been occupied with the problem of the production of light from electricity; and immense progress has, he says, been made in the way of improvement in this department, but relatively little attention given to the development of light by direct combustion. Yet, if we compare the latest and best developments in each direction—*i.e.*, the best incandescent lamp and the best gas-burner—as to the matter of economical conversion of the latent energy of fuel into the active energy of light, we shall, he states, find that the relatively simple, crude, and unimproved method of the gas-burner is still leading in the line of economy. In both cases the losses are enormous, and the possibilities of improvement immense; and it will, therefore, he thinks, be of value to see just how these losses are distributed, and where they are located in each case.

Considering first the "mechanical equivalent" of light, the author states that in 1865 Professor Julius Thomsen, of Copenhagen, showed that it was about 12·28 foot-pounds per minute, or 749 foot-pounds per hour, for each candle. Mr. M. G. Farmer, however, proved years ago, as the result of certain experiments made at Boston with an electric light, that it was about 10·1 foot-pounds per candle per minute. This would give an average of 11·29—say, 12—foot-pounds per candle per minute. If 1-candle power per minute represents 12 foot-pounds, 1-candle power for an hour would be equal to 720 foot-pounds in the same time. This being the "mechanical equivalent" of light, however produced, the author proceeded to find out what proportion of the total "mechanical equivalent" latent in a cubic foot of ordinary illuminating gas, is converted into light by burning in a standard gas-burner. Taking the Hoboken gas for the purpose of his investigation, he ascertained that it gave 640 heat-units per cubic foot. This multiplied by Joule's equivalent of 772, gives 493,080, or in round numbers 500,000 foot-pounds. In other words, a cubic foot of Hoboken gas, in burning, gives out 500,000 foot-pounds of energy. He then inquired how this would compare with the amount of energy developed in the form of light by the same quantity of gas. Burning in a Sugg standard burner so as to give the light of 16 candles, Hoboken gas would be consumed at the rate of 4 cubic feet per hour. This gives an efficiency of 4 candles per cubic foot. Each cubic foot will, therefore, give 4-candle power for an hour. Consequently each cubic foot so burned would, in an hour, give out light equal to twelve (the energy of 1-candle light per minute), multiplied by 4 (as there would be four candles), multiplied by 60 (the number of minutes), which is equal to 2880 foot-pounds; and this is the total energy of the light developed. While it is giving out the 2880 foot-pounds of light energy, it is at the same time giving out the 500,000 foot-pounds as the total energy of combustion. The percentage of light energy to total energy would then be 0·586 per cent.; or, in round numbers, 0·6 per cent. This shows that the Sugg burner turns the available total energy into light energy by a method which is very wasteful. Dr. Morton then tried the Welsbach burner, and found that the Hoboken gas consumed in it gave from 9 to 12 candles per cubic foot under different conditions. Taking 10 candles per cubic foot as a fair average, we should have 12 (the energy in foot-pounds per candle per minute), multiplied by 10 (the number of candles per cubic foot), multiplied by 60 (the time in minutes it would burn), or 7200 foot-pounds. This would be 1·4 per cent. of the 500,000 foot-pounds of total energy which a cubic foot of Hoboken gas contains. Both of these figures—the 0·6 per cent. for the ordinary burner, and the 1·4 per cent. for the Welsbach, Dr. Morton thinks—indicate a vast possibility of improvement in this method of transforming the latent energy of fuel into light.

Dr. Morton next turns to the incandescent electric lamp, to see how it stands in its economical relation when its light is compared with the energy expended in producing it. On this point, he says: In the case of the incandescent electric light, we find the following figures. Assume that practically we can get 10 lamps of 16 candles each for each horse power expended. This figure will make, for each horse power, 160 candles. Now, at 12 foot-pounds of energy per candle per minute in the form of light, this would give us 1920 foot-pounds of energy per minute, in the form of light, from these incandescent lamps. A horse power expresses 33,000 foot-pounds per minute. Comparing these numbers, we get 5·812 per cent. of the total energy developed as light, instead of 0·576 per cent. in the case of the gas-burner. In other words, in the electric lamp we have about ten times as much of the total energy usefully converted into light as in the ordinary gas-burner. With the Welsbach burner the relation is not so much in favour of the electric lamp; being as 5·812 to 1·4, or about four times as much of the total energy applied to the dynamo machine converted into light, as of energy in the gas so converted in the Welsbach burner.

Going back to the coal as the source of energy, Dr. Morto shows that we are at once confronted with this other conditio He remarks: In the steam-engines used for running electric lig plants (and this is not the result of mere guess, but of a number of measurements which have been made at the Stevens Institute, by various members of its faculty, on electric light plants), we utilize only about 5 per cent. of the energy of the coal used to produce the power applied to develop the electric current. On the other hand, in gas making I think it is fair to say that there is not any greater waste in the production of gas from coal than 50 per cent.; and therefore you get into the gas 50 per cent. of the energy of the coal. From this you will see that there is here the same ratio (1 to 10) between the gas and the electricity, only it is turned the other way. In order to turn the coal energy into motion (as in using the steam-engine to drive an electric light plant), we throw away 95 per cent., and only utilize 5 per cent.; in order to turn coal into gas, we throw away 50 per cent., and utilize the other 50 per cent. So that, getting 5 per cent. in one case and 50 in the other, the proportion is as 1 : 10. This brings the two systems to an equality again; for, starting with the coal, about as much of the total energy of the fuel is developed by the ordinary gas-burner as by the electric lamp. Thus, starting with the coal pile, and considering merely the question of the conversion of coal into light, one process is about as wasteful as the other, at present. I think this is a very encouraging thing to the gas makers. It shows us that, notwithstanding all the advantages that electricity has had, by reason of its attracting the attention of the most ingenious minds of the world, and with all the ingenuity, thought, and effort which have been devoted to it, the conditions are still so nearly equal in respect to developing energy from its crude source—the coal. I consider it shows that if even a moderate amount of the same genius and effort were turned in the direction of developing light from gas, and in improving the agencies which effect this conversion, we might hope for something very good indeed.

Having pointed out the advantages and the possibilities of the future with reference to the development of gas lighting, Dr. Morton refers to what has been done in the way of improving electric lighting, and concludes as follows:—"The peculiar lesson taught by the above considerations is, I think, that there is an immense field to be cultivated, with prospect of profit, in the development of light from fuel by the method of making and burning gas; and it behoves those interested in the manufacture of gas, and indeed the public generally, to aid in the cultivation of this field. Without such cultivation, notwithstanding its present advantages, gas as an illuminant cannot hold its present position. The mere cheapening of gas, I contend, is not the only, or the scientific method of correcting the manifest wastefulness of our present method of using it to produce light. It would be equivalent to saying that to secure cheap fuel was the right way to improve the steam-engine. In the case of gas, such a policy, if persisted in, can only result in relegating gas to the cellar, the kitchen, and the engine-room—to warm us, to cook our food, and to drive our machinery—and in replacing it as a means of illumination by electricity, which may, it is true, owe its very existence and life to the enslaved labours of its deposed rival, imprisoned in the furnace of the steam-engine, or labouring blindly in the closed cylinders of the gas-engine. I believe that gas, much as it has been abused, deserves a better fate; and it will secure it, if anything like the attention is given to its education and refinement as an illuminating agency which has been lavished upon its impalpable rival, electricity.

The Price of Coal and the Cost of Pumping Water.—In the accounts of the Stockton and Middlesbrough Water Board, there is a table showing the effect that changes in the price of fuel have on the cost of water pumped, and much more markedly the effect of the substitution of newer engines. In the past three financial years, the price of coals has advanced steadily. Delivered at the works, the coal cost in the first year a fraction more than 8s. 1d. per ton; and at the end of the last, which terminated in February, it had risen to a fraction over 8s. 9d. But although there had been a steady advance in the quantity of water consumed, yet the coal needed for pumping was less in quantity, owing to the perfecting of the machinery—indeed, the quantity used for the service of Tees-side towns is just about half of what it was; and thus with the increased pumping of water, and the reduction of the total quantity of coal used, the proportionate use of fuel has been brought down from 4·31 lbs. per 1000 gallons three years ago, to 2·17 lbs. now. Some of the engines do even better work than this. It is officially stated that "the new engines consume 1·45 lbs. per 1000 gallons pumped;" so that there is the possibility of a further reduction in the proportion, which may in degree neutralize that rise in the price of coal which must be looked upon as certain now. Over a longer period it may be said that the cost of coals rose from 0·195d. to 0·217d. per 1000 gallons, and that it has since fallen, as stated, to 0·102d. New engines, with the mains and other appliances, are costly, as the accounts show; but the results may be held to justify this expenditure when the current cost is brought down in the way indicated. In the case in question, the increase in the quantity of water pumped has been from 245 million gallons per month eight years ago, up to 255½ million gallons per month this year—an increase which is still continuing, and that in a more rapid ratio. It is evident, says the *Engineer*, that this increase with the more regular employment of the pumping-engines, and the more equal flow of the water, will have a tendency to reduce the proportionate cost; but there is also the effect of the less wasteful use of fuel which must be credited with part of the good result already named.

Register of Patents.

MANUFACTURE OF GAS.—The Gas Patents Syndicate, Limited; communicated from J. B. Archer, of Washington, U.S.A. No. 8559; June 11, 1888. [8d.]

This invention relates to apparatus for the manufacture of heating gas, by bringing superheated steam into intimate admixture with the vapours of hydrocarbon oils so that a chemical combination ensues.

Fig. 1.

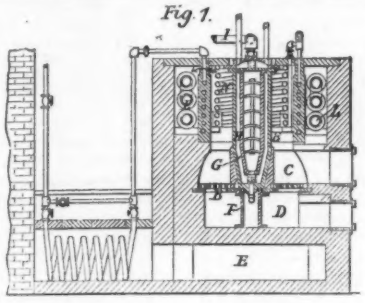


Fig. 2.

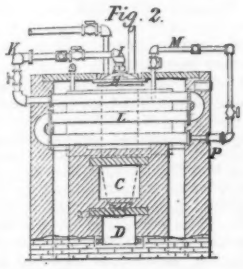
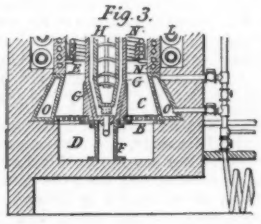


Fig. 3.



Figs. 1 and 2 are longitudinal and transverse sectional elevations of the apparatus. Fig 3 is a part section showing a steam superheating chamber surrounding the combustion chamber of the furnace.

The furnace is supplied with a circular grate B, a combustion chamber C above it, a circular ash-pit D (having front and side doors), and a flue E leading vertically up from the combustion chamber. The flue is surrounded by a cylindrical partition, which terminates just below the top of the furnace, so as to form a lateral passage for the products of combustion from it. Around the cylindrical partition and within the four walls of the furnace, is formed a heating chamber with which the lateral escape passage communicates, and which is connected by down flues with the chimney. The grate is formed of a number of (in this case four) annular segments which are supported at their outer edges by the furnace walls, and at their inner edges by a tubular standard F in the middle of the ash-pit. On the upper end rests a vertical retort G arranged centrally in the flue E; the lower part being conical and sheathed in a refractory casing. Within the retort is arranged a second smaller retort H, held to the cap of the larger retort by a pipe I passing upward. Within the inner retort are partitions in the form of spherical segments, perforated alternately on opposite sides; and at the bottom of the retort is a laterally perforated cylindrical sprayer. The pipe I leading into the inner retort H is provided with a valve, and is connected with a pair of branch-pipes K, provided with valves, and connected with sets of horizontal retorts L arranged in the heating chamber on opposite sides of the main flue E. The other ends of the retorts are connected respectively with like branch-pipes, and are both connected to a pipe M. This pipe is connected with a superheating coil N, which is arranged in the flue E around the retort G. The other end of the coil is connected with an outer superheating coil formed in the cylindrical partition. The pipe M is also connected directly with the outer superheating coil. Around the combustion chamber C is a closed annular box O, connected at the top and bottom respectively with the steam supply-pipe; a valve being arranged in the latter so that the box can be included in the main steam circuit, or cut out therefrom as desired. It is preferably divided into several compartments connected with each other by tubes, and is adapted to serve either as a superheating chamber for the steam, when connected in the steam supply circuit, or, as a boiler for producing steam, in which case water is introduced through the lower pipe and steam passes out through the upper one.

As the superheated steam passes through the injectors P into the retorts L, the valves in the branch oil-tubes being open, the hydrocarbon vapour produced in the oil-heater is drawn in by the injectors and mixed with the steam; and the mingled vapours pass through the retorts in which they are subjected to the heat of the escaping products of combustion. The mingled vapours issuing from the retorts then pass through the branch-pipes K together into the common pipe I, from which (the valves in the cut-out pipe being closed, and that in the pipe I open) they pass into the inner vertical retort H. In passing through the perforated partitions and sprayer of this retort, the vapours become "combined into a gas of great heating power." The gas is subjected to considerable heat as it passes upward in the space between the inner and the outer retorts H and G; and when it issues from the eduction-pipes, it is ready for use as a fuel.

LIGHTING AND EXTINGUISHING GAS-LAMPS.—Lake, H. H.; communicated from N. H. Shaw, of Somerville, and A. B. Shaw, of Medford, Mass., U.S.A. No. 13,610; Sept. 20, 1888. [8d.]

The characteristic feature of this invention is the combination with the gas-pipe and burner and with time mechanism for turning the gas on and off, of a spaced fulminate-carrier and a hammer actuated by the time mechanism so as to produce a spark when the gas is turned on.

Fig. 1. Fig. 2. Fig. 3.

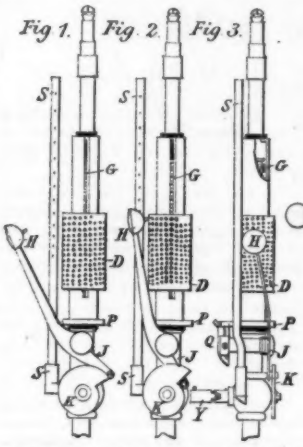
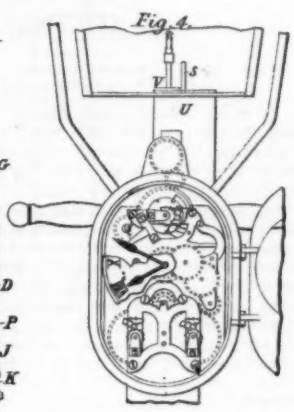


Fig. 4.



Figs. 1, 2, and 3 represent, in various positions, the gas-pipe, burner, fulminate-carrier, and hammer; figs. 1 and 3 showing the hammer retracted (ready to strike), and fig. 2 the position of the parts after the blow is struck. Fig. 4 represents a lamp to which the apparatus is applied, with the time mechanism for actuating it.

The fulminate-carrier employed has a succession of permanently fixed detonating charges spaced at regular intervals so as to be independent of each other. It consists of a metallic cylinder D, having a succession of peripheral pits each containing a small detonating or inflammable charge of fulminate, and arranged spirally around the cylinder, which is gradually fed upwards by a screw G, so as to bring the several charges successively into position to be exploded by a blow from the hammer H. After the fulminate has been rubbed into all the pits, the cylinder is coated with a water-proof composition; and the pits are so arranged that when each charge is exploded, the diverging walls throw the sparks outwardly, without affecting the adjacent charges. The hammer is actuated by a spring J, and cam K, fixed to the rotating shaft of the gas cock, and made to throw back the hammer against the pressure of the spring and suddenly release it.

While the fulminate cylinder is carried upwards by the screw G, on the gas-pipe, a slotted sleeve surrounding the screw, and a pin fixed in the cylinder and extending through the vertical slot of the sleeve, come into engagement with the enclosed screw. The sleeve has, at its base, a ratchet collar P, with a number of teeth equal to the number of pits in a single coil around the cylinder. It is moved to the extent of one tooth by a spring-pressed pawl Q, actuated by the oscillation of the pivot every time the hammer is retracted; the pawl being held in a slot in the opposite end of the pivot. Figs. 1, 2, and 3 represent the tube S laterally perforated in the part along which the cylinder D travels. Gas escaping from these perforations—or from the tube S, shortened and without perforation—rises, mixes with the air, and ignites with a flash when the hammer striking a fulminate charge produces a spark. The rising flame thus caused ignites the gas issuing from the burner—the cock being so constructed and moved by the time mechanism as to first open a passage for the gas to both the burner and the lighting tube S; then to turn further, shut off the supply to the tube S, while supplying the burner for the night; and at dawn to be turned by the driving mechanism so as to shut off the gas altogether.

The fulminate cylinder is, by preference, enclosed by a tube V which serves to protect the parts from the weather. A narrow slot or other aperture through such tube, gives the hammer access to the fulminate pits in the cylinder D, and another opening is required for the pawl Q to work in if the tube V is close fitting. U (fig. 4) represents a shell in the form of a somewhat flattened tube of such dimensions as to surround the gas-pipe, the cylinder D, the lighting tube S, and the hammer. This shell being open at the top and bottom affords an upward passage for the flame rising to the burner from the point of ignition at the hammer; and it also serves to prevent it from being extinguished by the wind. The clockwork or time-mechanism is enclosed in a suitable case mounted on the lamp-post; and the shaft of the upper gear-wheel are connected to the rotary cock by a coupling Y, as indicated in fig. 3.

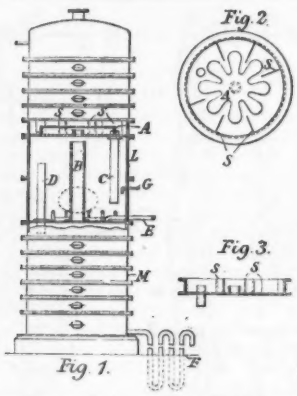
AMMONIA STILLS.—Davis, G. E., of Manchester. No. 16,349; Nov. 12, 1888. [8d.]

This invention (partly based on patent No. 15,540 of 1887) relates to column stills, in which the ammoniacal liquor is treated in thin layers with a current of steam whilst moving down a succession of trays or plates, of which the still is partly constructed.

In one of the forms of still referred to in the 1887 patent, the steam issues from a short neck upon each tray, and passing under a circular cap covering this neck, it emerges from serrations around the periphery of the cap through the liquid undergoing treatment. One part of the present invention relates to an improved construction of these caps, in order to render their action more effective. In a circular cap, the patentee remarks, it is the periphery only that is effective; it is from the periphery alone that the steam escapes, and so comes in contact with the liquid undergoing treatment. So that, to a very great extent, all other things being equal, the length of the contour line of the cap determines the efficiency of the still.

Fig. 1 (see next page) is an elevation of a complete column still fig. 2 is a plan of one of the trays or plates of the still, showing the improved construction of cap applied thereto; and fig. 3 is a sectional view of one of the trays.

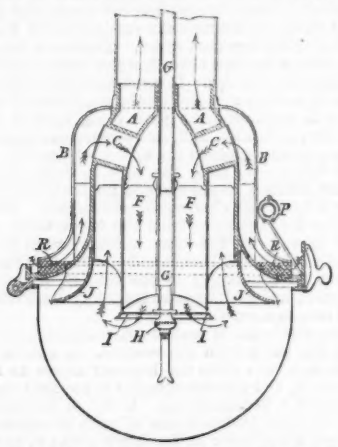
The caps A covering each neck, are of such form that the outer edge in plan is represented by a deep sinuous curve, as shown by fig. 2; and the whole of this contour line is serrated, to allow of the escape of the steam and gases from underneath. Stops S are also cast upon the trays upon which the caps rest, in order to compel the liquid to travel the sinuous path from the inlet to the outlet of each tray. The still is



made in one column M, in which a certain number of the trays and caps (preferably six) are employed for liberating the volatile ammonia. These trays and caps are placed at the upper part of the still. A sufficient number of similar trays and caps (also preferably six) are placed at the bottom of the column for liberating the fixed ammonia after it has been displaced from its acid combinations by means of lime. Between these two series of trays and caps is placed the liming vessel L, through which the steam and gases are conducted from the lower trays by means of the pipe B of wide bore. This heats the milk of lime on its passage through it, the pipe C bringing the liquor into the liming chamber L from the trays above, and the overflow pipe D conducting the liquor from the liming chamber into the trays below. The milk of lime is forced into the liming chamber at the pipe G, and the lime is further heated and kept in agitation by the fixed steam-pipe E.

GAS-LAMPS AND BURNERS.—Bruers, L., of Brussels. No. 18,223; Dec. 13, 1888. [8d.]

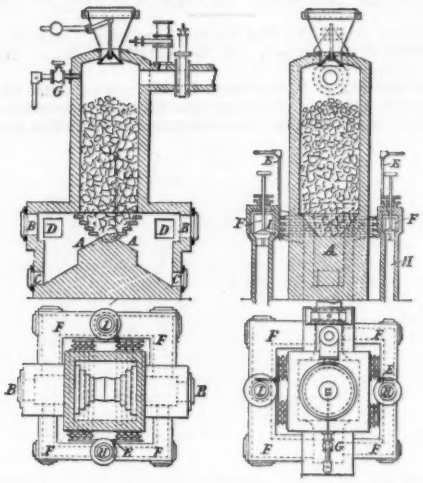
This invention relates to the construction of gas-lamps containing a cylinder with radiating partitions and gills (or they may be radiating discs) fitted within the body of the lamp and forming hot chambers or partitions through which the air for feeding the flame has to pass and become heated so as to produce greater regenerative power.



In the illustration, A is a hollow casting, fitted with a bell-shaped cover B, which rests on a shoulder at its upper part. In the casting are apertures or passages C, for allowing the air to flow from the exterior to the interior; and below the hollow casting is a double concentric cylinder divided by partitions and gills into a number of compartments F, which extend downwardly towards the burner. The air for feeding the burner, after traversing the heated hollow casting, passes down these compartments and becomes further heated before reaching the burner H which is fitted at the lower end of the gas supply-pipe G. The cylinder is supported by screwing on to the lower end of the gas supply-tube G; and in its turn it supports the hollow casting by taking into flanges on its lower edges. The lower end of the inner concentric ring of the cylinder is formed as a deflector plate I, having perforations around the burner; and the outer concentric ring is furnished with a reflecting bell J. The glass is supported in a moveable frame hinged to a fixed frame in which a series of small holes are pierced, through which air from the outside can pass for the purpose of keeping the reflector cool and to feed the flame. In order to prevent any accident by the sudden release and fall of the glass frame, a spring pulley P (with a cord or chain) is arranged, one end of which is attached to the glass frame and controls the lowering or fall of the latter. In the space left between the mouth of the cover B and the frame N, wire gauze R is inserted to check any sudden inrush of the air which flows through this space, and becomes slightly warmed in its passage to the hollow casting A; is again further heated in the hot-air compartments or pockets F; and feeds the flame at the burner. The products of combustion escape upwards through the inner and outer walls of the double cylinder D, and serve to maintain the cylinder and the casting at a high temperature, and finally issue from the chimney S.

WATER GAS.—Langer, J. von, and Cooper, L., of Leeds. No. 6659; April 18, 1889. [11d.]

This invention relates to the construction and working of gas generators or producers, the arrangement of the plant, and the system of working in groups, for the efficient and economical generation of water gas, or of the producer gas used in obtaining water gas.



The illustrations are vertical sections through the centre of the generator or producer, and plans of the sections respectively.

The hearth A slopes downward on each side from the centre; and, with the fire bars, supports the fuel placed in the upper part of the producer. This upper part is square, and springs from an elongated rectangular-shaped base, which contains (besides the sloping hearth) two transverse sets of fire bars, fire-cleaning doors B, opposite each other, ash and clinker doors C, and gas outlets D. The fire bars are preferably made tubular, and connected to a water service E to keep the bars cool. They are flattened tubes, placed horizontally, and stepped outwardly on each side from the bottom. The current of the air blast and gases, as generated, is divided by the double slope of the hearth and two sets of fire bars; and passing downward through the bars, it finds its way to the oppositely-placed outlets D. The steam used in the process follows a similar course; and the result is said to be a more equable condition of the mass of fuel than where the current is directed to the centre, as in other forms of producers. In the plans, a belt pipe F is shown extending around, and communicating with, the producer through the gas outlets, as indicated by dotted lines. From this belt pipe the water gas is conveyed through the valve H and dip-pipes to a scrubber; and the producer gas—as generated—from the belt pipe through the valve I to an underground conduit E, and thence to a hot-blast regenerator stove, or to any other point required. The producer is fed with fuel through the top, close to which are placed a steam or water pipe supply-valve G and a valve to supply hot air from a blast pipe.

In working the producer, after it has been charged with fuel and fired, the hot blast is turned on (the steam-pipe being closed), and highly-heated air is passed downward through the burning fuel, passing in the divided manner already described through the fire bars and gas outlets D, to be carried off through the producer gas valve I, until the fuel is in a high state of incandescence. The hot blast and producer gas valves are then closed, and the steam-valve G and water-gas valve H are opened, until the steam—passing through the incandescent fuel—has cooled the latter down to a point below which it is not expedient to go, when it is shut off, together with the water-gas valve H. The steam is decomposed in its passage through the incandescent fuel, and forms water gas in the well-known manner, which may then be conveyed from the producer to the scrubber, as required.

APPLICATIONS FOR LETTERS PATENT.

15,740.—SAVILLE, G. E., "The regulator washer as applied to gas." Oct. 8.

15,741.—SAVILLE, G. E., "An improved gas-exhauster." Oct. 8.

15,742.—VICKERMAN, W., "Improvements connected with the joints of gas-brackets, branches, pendants, or other like fittings." Oct. 8.

15,753.—REED, J., "An improved pressure-gauge for gas and other purposes." Oct. 8.

15,797.—PAISLEY, J. R., "Improvements in or connected with apparatus for the manufacture of water gas, applicable for gas-engines and other purposes." Oct. 8.

15,848.—SHELTON, J. A., "Improvements connected with kerbings of pavements as means or apparatus for containing electric and like wires, gas, water, or other pipes or the like." Oct. 9.

15,867.—THOMPSON, C., "Improvements in gas-furnaces." Oct. 9.

15,885.—CLAYTON, S., "Improvements in fluid-meters." Oct. 9.

15,901.—HASLAM, E., "Improvements in gas and oil cooking-stoves." Oct. 9.

15,947.—FERGUSSON, J. H., "Improvements in and connected with the manufacture of illuminating gas from coal and analogous material." Oct. 10.

15,957.—SIMPSON, W. M., "Improvements in gas heating apparatus." Oct. 10.

15,987.—GREENHILL, M. C., "Improvements in and relating to coin-freed apparatus as applied to the delivery and distribution of illuminating gases." Oct. 11.

15,988.—HAWORTH, J., "Improvements in apparatus for manufacturing illuminating and heating gas." Oct. 11.

15,990.—LEACH, W., "Improvements in mechanical stokers, and in means to be employed for indicating or registering the weight of coal consumed." Oct. 11.

15,999.—SHAKESPEAR, J. D., "Utilizing the heat that radiates to waste from the edges, sides, &c., of gas and similar stoves, especially from such known in the trade as grillers, broilers, toasters, &c., and so increasing their efficiency and economy." Oct. 11.

Correspondence.

[We are not responsible for the opinions expressed by Correspondents.]

THE WIRE-ROPE AND SPIRAL SYSTEMS OF GUIDING GASHOLDERS.

SIR,—With your permission, we should like shortly to notice Mr. Gadd's letter in your last issue. In it Mr. Gadd draws the attention of your readers to several extracts from his complete specification. In our view, it is the wording of the preliminary specification, filed in December last, that is of interest, and in it we fail to see any allusion whatever to tensional support. Mr. Gadd remarks in his letter that he reluctantly determined to bring out another patent "to prevent the field being flooded with these imitations or variations of the originally published idea." In the "original," as is well known, guides, either in the tank or on the holder, play the essential part; and in the preliminary specification of the latest patent they do the same, though varied in form. In the complete specification just published, however, wire ropes are introduced, and guides cease to play any part at all—as wide a departure from the "originally published idea" as can well be imagined. That the new system we had in hand involved the use of wire ropes, was known to all readers of the gas papers months ago, and was then regarded as something absolutely new and original. We utterly fail to see on what Mr. Gadd bases his imputation of want of "originality," or by what process it could be evolved from his spiral guiding. It seems strange that an inventor with originality should be content to leave so large a question as the tensional support of gasholders in so crude a form as it appears in the specification just published. For instance, since holders have a top and bottom curb, why not make use of both in steadying the holder? This has been strangely neglected in Mr. Gadd's "studies on the subject."

Since both your readers and Mr. Gadd are unacquainted with Mr. Pease's complete specification, we do not ask for any judgment. It will, however, be found to be exceptionally full and complete, with details and drawings for all descriptions of holders. Until this is in their hands, we ask your readers to suspend their judgment on the wire-rope bracing system.

ASHMORE, BENSON, PEASE, AND CO., LTD.
(per E. Lloyd Pease, Director.)

Stockton-on-Tees, Oct. 18, 1889.

SALE OF SHARES IN THE RICKMANSWORTH GAS COMPANY.—Last Wednesday, Messrs. Humbert, Son, and Flint offered for sale 66 £5 shares in the Rickmansworth Gas Company; the prices realized being from £8 10s. to £8 15s. per share, or an average of £8 13s. 4d. each. The dividend paid by the Company last year was 7½ per cent.

THE CONDITION OF THE DUNEDIN CORPORATION GAS-WORKS.—Our readers will remember that the Dunedin Corporation were a short time ago convicted, in a penalty of £25, for allowing the emission of sulphuretted hydrogen from their gas-works. The case was quite recently reported in our columns; and therefore the facts need not be recapitulated. Judging from what has transpired at subsequent meetings of the City Council, some of the members are of opinion that the works are in such a condition that the Council will be liable at any time to similar proceedings; and the attention of the Gas Committee is to be directed to the matter.

THE PRICE OF GAS IN THE SALFORD OUT-DISTRICTS.—A meeting of the representatives of various Local Authorities who obtain their gas supply from the Salford Corporation Gas-Works, was held last Tuesday, at the Victoria Hotel, Manchester, for the purpose of considering various matters relating to the gas supply. Counsel's opinion was submitted, to the effect that the Authorities were quite justified in refusing to submit to a differential rate, and advising that proceedings should be taken for the recovery of the amounts overcharged by the Salford Corporation. It was agreed to adjourn the meeting, in order that the representatives might ascertain whether their Boards would be disposed to join in taking action against the Corporation as advised. The subject of the proposed appointment of a Royal Commission to inquire into the alleged maladministration of the gas-works was brought forward, but no action was taken in regard thereto.

EXPLOSION OF GAS AT THE LEEDS TOWN HALL.—Yesterday week, a number of workmen were engaged dismantling the Leeds Town Hall of the adornments used at the recent Musical Festival. The men were removing some of the larger pines used in the decorations, when one of them caught a heavy gaselier in the corridor near the artistes' room, bringing it down. Immediately there was a rush of gas from the broken pipe. Parfitt, the gas inspector, was at once summoned; and he first turned off the gas at the meter, and then told his son to plug the pipe at the ceiling. Young Parfitt mounted a ladder, and, knowing that the gas was turned off, struck a light the better to see what he had to do. Unfortunately, some gas remained in the pipes and about the ceiling, and an explosion followed. A large body of flame shot downward, and burned the young man very seriously about the hands and face, though happily his sight was not affected. He was taken to the Infirmary, where it was found necessary to retain him for a few days.

THE HINDLEY LOCAL BOARD GAS UNDERTAKING.—The Hindley Local Board having applied for authority to borrow £2000 for gas-works purposes, Major-Gen. C. Phipps Carey, R.E., attended at the Board Room, last Thursday week, to hear the details of the scheme, and to take evidence upon the matter. It was stated by the Clerk (Mr. S. Holt) and the Gas Manager (Mr. W. Dickinson) that the loan had been rendered necessary by the demand for a gas supply for the township of Abram—a district within the gas-supply area of the Local Board. The population of Abram in 1881 was 2638; but it had rapidly increased, and was now about 3500. The Abram Local Board had entered into an agreement to light their district, and would require about 80 street lamps; and Mr. Dickinson had obtained about 200 more consumers. On the 25th of March last the capital of the gas undertaking (£52,500) was all exhausted, with the exception of £409, of which sum they had since spent £194 for ordinary extensions of mains and services. The £2000 would all be required for the enlargement of the works, &c., proposed in the Abram district. An increased demand for the supply of gas had arisen through large reductions in the price made by the Board in December last. The net charge to large consumers was now about 2s. 8d. per 1000 cubic feet; to small consumers, 3s. The number of consumers in the Hindley district alone since March 25 had increased by 63, and was daily growing. During the first six years the Board had the gas-works, there were losses incurred to the amount of £4478, which had now all been cleared off from the profits, which were £276 for the last year. There was no opposition to the proposed loan.

Miscellaneous News.

GAS WORKMEN AND THE LABOUR QUESTION.

The Gas Committee of the Birmingham Corporation held a meeting on Monday last week, to consider the re-arrangement of the hours and conditions of labour at the Saltley, Windsor Street, Adderley Street, and Swan Village works, in consequence of the adoption of the eight-hour shifts. Alderman Pollack (Chairman of the Comimttee) presided. The Works Sub-Committee, who had met earlier, submitted, in conjunction with the Gas Engineers (Messrs. Hunt and Hack), a new schedule, arranged in connection with the men, of work and pay for the stokers, firemen, coke wheelers, and other *employés* at the several works; and after a short discussion it was approved. The Committee claim that this practically concedes what was asked by the stokers—first, in reducing the shifts from twelve to eight hours, and next in regulating the work within the reduced time. The men in their memorial asked that the limit of work for stokers should be 24 retorts charged and drawn, or 48 charged only. The new schedule concedes a minimum of 26 charged and drawn (the number ranging up to 32 according to conditions), and 52 charged only. The work of the other men has been made as nearly as possible in proportion to that of the stokers, and the pay has been raised 3d. per day all round. The daily wages of stokers and firemen will henceforth be 5s. 3d. (with extra allowances for special work for firemen); coke wheelers, 4s. 6d.; pipe jumpers, 4s. 3d.; and machine men, 5s. 9d. It was determined that the new shifts and increased pay should come into operation with the commencement of the next working week. It is estimated by the Engineers that the reduction of hours and increase of pay will entail an addition of £12,314 to the expenditure of the Gas Department, apportioned as follows:—Saltley, £4650; Windsor Street, £3050; Adderley Street, £1600; Swan Village, £1400; and for additional gangers, valve, engine, and boiler men, £1614. The Committee also approved of an interchange of work between stokers and firemen, in fixed proportions, at the Windsor Street works, but not at Saltley or Swan Village. A register of attendance will be kept, and the workmen's holidays will be liable to forfeiture for irregularity or absence from work without leave or the provision of a substitute.

In the JOURNAL for the 1st inst., we noticed the movement initiated by the stokers and workmen at the Richmond (Surrey) Gas-Works for a reduction of labour and certain other advantages. The Directors have conceded the demands of the men, who have passed a resolution expressing their pleasure at the satisfactory way in which they were met, and at the courteous treatment they received from Mr. T. May, the Company's Engineer.

We have, in previous issues, alluded to the dissatisfaction of the stokers at the Bradford Corporation Gas-Works with the conditions of labour which exist there. The men recently held a meeting at which they passed a resolution asking the ratepayers to assist in having their grievances remedied. They have since formulated their demands, which are as follows:—(1) That stokers shall not be called upon to attend to more than the 20 retorts they have at present to look after. (2) That low fires, scurfing, and coal trimming by the stokers shall be done away with. (3) That coke trailing be likewise abolished. (4) That stokers shall still be paid 5s. per eight-hour shift. (5) That time-and-a-half shall be paid for work done between 6 a.m. on Sundays and 6 a.m. on Mondays; Christmas Day and Good Friday—for which the men are paid double wages—to remain as before. (6) That low-fire men are to look after eight fires and clean four, and that their pay shall be 5s. per eight-hour shift. (7) That coal trimmers shall have 4s. per eight-hour shift. (8) That yard-men and purifiers shall receive an advance of 4d. per shift. (9) That all permanent hands shall be allowed one week's holiday per year. At a meeting held last Sunday week, these demands were put separately in the form of questions, and were approved of; and a resolution was passed pledging the men to adhere to them in their entirety. The demands of the men were sent in; but no definite response having been received by Thursday last, the men held a meeting in the evening, which was largely attended. There was little discussion upon the nature of the men's grievances; it appearing to be taken for granted that their views on this point were unanimous. The main question was as to what course should be taken to ensure compliance with the demands. Several of the men said they had been spoken to individually by the Engineer (Mr. D. Swallow), who had hinted that their wishes would be acceded to with, perhaps, slight exceptions, if they would only wait patiently until the Chairman of the Gas and Electricity Supply Committee of the Corporation (Mr. Alderman F. Priestman) had returned from his holiday. There was, however, a strong expression of opinion that the men were being put off from time to time, with the intention of keeping the agitation in check until near the end of the year, when they would be at the mercy of the Corporation, and many of them would either be discharged or sent into the yard to work at lower wages. Some vigorous speeches were made in the course of the evening; and at one point, when indignation was waxing hot at the scant attention paid to the memorial of the men, one of the organizers of the movement interposed, and advised the men to dispose of every possible excuse for the Committee by patiently waiting for another week, and passing a resolution that, if no attempts at conciliation were made during the interval, they would then give in their notices. He urged that if they displayed this forbearance and disposition to do all they could to avoid a struggle, they would have a much better claim to public sympathy than they would otherwise possess. This suggestion was generally approved, though three different courses were formally proposed and discussed at considerable length. Many of the men declared themselves in favour of an immediate seven days' notice, though it was clearly stated that if they left work on anything less than fourteen days' notice they were liable to imprisonment. Others, while admitting the necessity of a fortnight's notice, thought that it should be given at once. Eventually, however, it was decided to adopt the original proposal, and await the return of Alderman Priestman, though strong condemnation wes expressed of that gentleman's action in leaving town for purposes of pleasure in the midst of an agitation which so seriously concerned the workmen under his control. Another reason for the delay was that it was considered improper to commit the men who were busy at the works at the time of the meeting to so resolute a course at such short notice to them as would have been given if immediate action had been resolved upon. The following are the terms of the resolution passed:—"That in the event of no answer being received by the Secretary before next Thursday [the 24th], we hereby resolve to give the usual fortnight's notice to-morrow (Friday) week. In the event of an answer being received, a meeting shall be held this night week to consider the same."

We referred last week to the fact that the stokers at the Bath Gas-Works had applied for an alteration in their work and pay; the following being the terms submitted to the Directors:—"That the stokers shall receive 5s. per day for an eight-hour shift, and that each stoker shall draw and charge 20 retorts. That the firemen shall receive similar pay, and be required to work only six fires a shift. That the yard-men shall receive

3s. 6d. for an eight-hour shift. That the labourers shall be paid 3s. 4d. for 9½ hours' work." Interviews between the men, the Directors, and the Engineer (Mr. C. S. Ellery) have taken place, with the result that the following wages will now be paid:—Stokers, 4s. 6d. per day of eight hours, to charge 20 retorts per man, with time-and-a-half on Sundays; firemen, the same wages and hours; coalers, 3s. 8d. per day of eight hours; and heavers or yard-men 3s. per day of eight hours. Formerly the firemen were paid 4s. 8d. for 12 hours' work; the stokers, 4s. 3½d.; the coalers, 3s. 6d.; and the heavers, 2s. 10d.

Following the example of the gas workers in other parts of the country, those employed by the Corporations of Manchester and Salford are taking steps to have their working hours reduced from twelve to eight per day. Memorials were accordingly presented to the Gas Committees of the city and borough early last week, in which the following was given as a fair scale of work and wages:—(1) Stokers to carbonize 63 cwt. of coal or cannel each shift of eight hours. (2) Coal or cannel to be weighed for the stokers. (3) Firemen to look after five fires; wages to be 5s. per shift of eight hours. (4) Boiler firemen to work eight-hour shifts, at 4s. per shift. (5) Crane drivers, railway men, &c., to work eight-hour shifts at the present rate of wages. (6) Coke wheelers to wheel for two stokers and look after the fires. (7) Coal wheelers to wheel 11 tons ½ cwt. in eight hours. (8) Engine drivers of the carbonizing department, eight-hour shifts at the present rate of wages. (9) Yard-men to be paid 22s. per week of 54 hours. (10) Overtime to be paid for as time-and-a-half; Sundays double time. (11) Men ordered to attend sick to be paid 1s. if sent back without work. (12) Seven days' notice to be deemed sufficient from or to employer. The memorial of the Manchester men was laid before the Gas Committee, at their meeting on Wednesday last, by the Gas-Works Superintendent (Mr. C. Nickson), and discussed at great length. No decision was, however, arrived at; the general opinion being that the proposals required further consideration before any definite reply could be given to the men. The Salford men's memorial was presented to the Gas Committee of that Corporation on the same day, by the Gas Engineer (Mr. S. Y. Shoubridge), and it was fully considered, and the whole matter referred to a Sub-Committee for investigation and report. On Friday, a deputation from the men had an interview with the Sub-Committee, and discussed in a friendly way the terms of their memorial. Nothing definite was done; the object being to ascertain really what are the grievances of the *employés*. The Sub-Committee expressed themselves willing to make concessions; and the deputation left with the understanding that in due course proposals in reply to the memorial will be put before them for consideration. All the men affected—upwards of 200 in number—have, we understand, sent in their notices, and they appear determined to cease work if the reply they receive is not satisfactory.

Last Thursday, a deputation from the men employed in the gas-works of the Leeds Corporation waited upon the Gas Committee with reference to their hours of labour and their remuneration; the object of the men being to have themselves placed on a footing with those engaged in similar occupations in other places. After some discussion, it was suggested that, if possible, an amicable arrangement should be come to. With this object, it was decided that the men should appoint a Committee to obtain particulars as to the work in other towns, which could be placed before the Gas Committee; the latter on their part, electing a Sub-Committee to procure information bearing on the question from their point of view. The men held a meeting in the evening, and unanimously agreed to proceed on the lines suggested.

A meeting, said to be attended by 3000 people, was held in Saville Park, Halifax, last Sunday, to express sympathy with the efforts of the gas workmen to obtain better conditions of employment. Speeches were made by officials of trades unions and others; and it was stated that 76 of the men employed at the gas-works in the town had become members of the Stokers' Union. At a meeting of the Gas Committee of the Corporation last Friday, the Engineer and Manager (Mr. T. Holgate) reported the result of an interview he had had with a deputation from the men. The Committee expressed themselves desirous of meeting the men in any reasonable requests; and Mr. Holgate was directed to ascertain more precisely what is required, and report to a future meeting. It is stated that some complaint of the coalers has already been satisfactorily arranged.

LETTING GAS-STOVES ON HIRE AS AN ORGANIZED BUSINESS.

A recent issue of *Light, Heat, and Power* contained the following article on the above subject, by Mr. H. Q. Hawley, of New York:—

Whatever the situation has been in previous years, there is no question that at the present time the public are weary of the dirt and trouble attending the use of coal in domestic life; and, where choice is possible, would gladly abandon it in favour of gas, as soon as they were convinced that the change is practical and can be safely made. And it is equally true that it is the uncertainty alone upon these questions that has kept coal king so long. I propose, therefore, in this article, to inquire: (1) How far the uncertainty I refer to extends, or rather how far it does not extend? (2) What is required to remove it altogether? (3) What result in that case can be reasonably depended on—*i.e.*, if manufactured gas (to which this paper is confined) were generally used as a fuel in cities?

Firstly, then, although the public as yet have but a limited knowledge of the fact, experience has fully proved that for cooking in summer, and small and intermittent heating purposes, manufactured gas, even as now burned, is, at any reasonable charge for it, cheaper than coal. So far, therefore, as these purposes, are concerned, all that is required to secure their general use is to fix public attention upon them. But if gas cannot be advantageously used as a fuel, except for summer cooking and small heating purposes, it is evident it can never take the place of coal. To bring it to that height, it must be made a winter as well as summer fuel, and as economical for large as for small uses. Is that possible?

It is not because manufactured gas is deficient in heating energy that its use as a fuel has been so limited, but (1) because so much of its heat, as it is now used, is wasted, from no adequate provision being made in any of the apparatus generally used for burning it, to protect the heat generated from dilution with cold air before it is used—as anybody can see by examining the construction of a Bunsen stove; and (2) because, however convenient the Bunsen system is, experts know that its operation necessarily liberates carbonic oxide, to carry which off by a flue to the chimney greatly increases the waste.

Now, assuming the above positions well taken, it follows that to bring out the full value of manufactured gas as a fuel, and prevent its use in cooking from being injurious to health, it must be so burned (1) that the heat generated at its ignition will be sufficient to maintain the products of combustion escaping unconsumed at that point at the high flame temperature required to burn them up—in other words, it must be burned in a pure state instead of by the Bunsen system, as in the latter case the fuel available at ignition is only one-fourth what it is in the former; and (2) what heat is generated in either of the above cases must be saved, instead of wasted. And it further follows that when the gas is burned and its heat saved as the above conditions require, to secure its full value it should be as practical a fuel as coal, and preferable to it where increased cost is compensated for by considerations of health, convenience, comfort, and use in the arts; and I make the assertion not only as a theoretic inference, but as an accomplished fact.

There are now upon the market gas heating-stoves constructed to meet the above conditions, and which, at New York prices for gas used, will fully heat rooms 16 to 18 feet square, in winter weather, at a cost of 2c. to 3c. per hour, working time; and also gas cooking-stoves for family use of like construction, and operating with like economy. Nor is that all, as I learn that house-heating furnaces are now being made upon the principle explained in this article, with the expectation that the cost of their operation will not exceed the cost of coal more than $70 to $80 a year. If gas can be practically employed for house heating, there is no reason why it cannot be as well applied to heating steam-boilers for many uses where uniformity of heat is an element influencing cost, and for other purposes which could be mentioned.

But enough has been stated to bring us to the question: Is it not time that, in comparing gas with coal as the fuel of the future in our cities, we should put aside old prejudices, and be governed by common sense? For whatever improvement the situation is capable of reaching, it is evident that little advance in it can be made while gas companies show so faint an interest in its development, and the public know so little about it. This brings us to the second question: Assuming that manufactured gas can be practically used for many fuel purposes for which it is not now employed, what is required to induce the public to use it for such purposes, and what results can be reasonably expected to come from such use?

I will discuss these questions separately (beginning with the first) by admitting that the means relied upon even at this day to convince the public that gas can be made a practical fuel for general uses, are precisely what its opponents might urge as proof to the contrary. For what are the facts? (1) The cooking-stoves in general use are admitted by the makers to liberate carbonic oxide into the air around them, and therefore cannot be safely used in close chambers and in winter. (2) No heating-stoves, with rare exceptions, are on sale except for use in bath-rooms, &c.; and, when they are not on the carbonic oxide principle, require so much gas to make them effective that their use is not practical. (3) Can anything be more impracticable than the advice given in the gas cooking lectures so much relied upon to educate the public? In the first place, it is always addressed to ladies who never go into the kitchen; and if those who do go acted upon it, they never would go a second time. For it requires the weighing, selecting, and mixing of the ingredients of the dish to be cooked, with one hand, while the other holds a watch. Not that cookery lectures are not required in introducing gas fuel to the public—in fact, no illustration of its use for that purpose can do without them; but cooking is work and not amusement, and therefore the advice needed for it should be confined to common and not æsthetic uses.

Taking all these considerations into account, is it strange that the public are unwilling to buy expensive gas-ranges, and when they do buy them always keep the coal-stove in readiness for accidents; and that gas heaters, for any but small uses, are regarded as a luxury as yet unattainable?

And *vice versâ*—that is, assuming, as I have proved, that the public would use gas generally as a fuel if they were convinced that it could be done safely and successfully—does it not follow that its use to secure that result must be made an organized business, and like all other business will succeed or fail just as it is treated? And why should it not be so? Is the selling of gas as a fuel above the laws governing trade? Will it take care of itself? The gas companies appear to think so, as all they generally do is to permit a few stoves to be placed in their offices for sale when customers inquire. Could any other business follow a shorter road to bankruptcy? No. And the earlier they recognize the fact, the better it will be for them, as the situation will soon be beyond their control. It is evident why.

If the facts given in this article prove anything, it is: (1) That if the public were educated up to the possibilities of manufactured gas as a fuel, it would be so used generally, at least in domestic life. (2) That as few will buy expensive apparatus while they are uncertain as to its operation, there is no other way for securing its general use except by furnishing it upon a rental, and under proper supervision, while required. (3) That the inducements to such an undertaking are so great that, where gas companies neglect to act, local companies can be found to do so in co-operation with them or without it, as it can be easily shown that no other legitimate field open to capital will give a like return. For instance, cooking-stoves, complete for family use in winter as well as in summer, can be made of cast iron, at a cost of from $12 to $25. I will take for our estimate the smallest size—viz., a stove having four cooking-holes, and so arranged that a boiler for clothes-washing, a portable oven for baking, and a portable broiler (all included in the $12 except the boiler, which every family has) can, at will, be used over them, with a consumption of gas when all four holes were used, of 25 to 40 cubic feet per hour at most. Now assume such a stove put up and taken care of by the company until the party using it is familiar with its operation, who would hesitate to pay a daily rental of 1c. for its use, upon condition that if the oven was injured outside ordinary wear and tear, the damage would be made good by the user. And yet, at this rent for a year (which time should be agreed upon for the first year), the annual profit upon the investment would be at least 20 to 25 per cent., as the only material charge against it, except 60c. interest would be for attendance.

And if this showing is half true; and it must be noted that it applies as well to heating as to cooking—if stoves for the former, as efficient as coal-stoves of like size, can be made and furnished (as they can be) at the cost and rent above assumed for the latter, how long will it be, if the gas companies hold back, before local companies will be formed in our large cities to take their place? Not beyond the present year for a beginning at least, if the letters sent in by representative men mean anything.

A word or two more as to the effect of personal effort in other business, and I have done. I will take the sewing-machine, as it is an extreme case. Its price to the user, when first introduced and long after, was five times its cost to the maker; and yet to-day there is one in every house. Is not the need for the practical use of gas as a fuel in domestic life as great as was the demand for the sewing-machine when it was first offered to the public? And if personal effort made that a success in the face of obstacles otherwise insurmountable, how much more should it accomplish for gas when everybody wants it, and it can be had without trouble or other cost than a trifling monthly rent.

THE STOPCOCK QUESTION AT FOLKESTONE.—Some considerable discussion has been going on at Folkestone with reference to a notice sent out by the Water Company to the effect that if consumers do not put in stopcocks within a week, the supply will be cut off. The Town Clerk states that he has received a notice that the Company intend putting in the stopcocks and valves themselves; and therefore the best way to proceed was to ask the Company to do the work.

THE MUNICIPAL GAS UNDERTAKING IN PHILADELPHIA.

The report of the Department of Public Works of the city of Philadelphia for the year ending Dec. 31, 1888, has lately been issued. It contains statements as to the working of the various bureaus composing the Department in the above-named period, and affords facilities for comparing the results obtained in previous years. The Director of the Department is Mr. Wagner, from whose report on the Gas Bureau the following particulars are extracted.

The estimates of receipts and expenditure sent to the City Controller were in excess of the actual results of the year; but not to a very considerable extent. The receipts from all sources were $124,618 less than the estimates; the expenditure, $142,205 less. The deficiency in the receipts was caused by failure to take into account the fact that for nearly four months of the previous year gas had been sold at $1·60 per 1000 cubic feet; and the diminution in the receipts, arising from the lowering of the price of gas, was overlooked in making a comparative estimate. The total receipts were as follows:—Gas, $3,281,353; residual products, $458,870; compensation for damages caused by the Schuykill River East Side Railway Company, $125,000; miscellaneous, $10,160—total, $3,875,383. The total expenditure was $3,321,962; being $3,107,796 for current operations, including public lighting, and $214,166 for new holders and mains. The excess of receipts over expenditure was therefore $553,421. The balance reverses the figures for previous years, when the total expenditures were larger than the receipts; practically wiping out the cash balance on hand at the beginning of 1884. At the end of that year there was a deficit of $110,149; at the close of 1885 it was $143,590; of 1886, $140,933; and of 1887, $108,528. Mr. Park states that the reversal of the balance above mentioned arose solely from economical management introduced in 1887, and continued during last year; as well as from the introduction of labour-saving machinery and modern processes of gas manufacture. New works have been constructed under a contract with the Philadelphia Gas Improvement Company, who will make water gas; but no gas was produced by them so as to affect the accounts for the past year. If to the $553,421 is added the sum of $804,237, the value of the 536,158,081 cubic feet of gas delivered free of cost to the various city departments and for lighting the city, some approximate idea is reached as to the worth of the works at the present time, and as to their increased value in the immediate future. Concerning the gas furnished to the public lamps, attention is called to the fact that on the books of the city and in the Controller's report, the Gas Bureau is charged with the expenses of lighting and maintaining the lamps, but not credited with the value of the gas supplied—a matter of procedure which the Director very justly claimed as improper and misleading, when the cost of the management of the Bureau is under consideration. For the public service, the quantity of gas furnished during the year was 11,402,600 cubic feet more than in 1887; while the cost of maintenance, as compared with the previous year, decreased $16,317·53. The public lamps now burn all night and every night.

Coming to the statistics of working, we find that in 1887 the works carbonized 671,631,600 lbs. of coal, which produced 3,154,842,000 cubic feet of gas; being an average of 4·697 cubic feet per pound of coal. Last year 673,748,735 lbs. of coal were carbonized, which produced 3,209,874,000 cubic feet of gas; being 4·701 cubic feet per pound. The following table shows the cost, for the past five years, of 1000 cubic feet of gas in the holder and at the consumers' burner:—

Year.	Cubic Feet.	In Holder.	Delivered.	Extensions.	Total.
1884 . . .	2,557,678,000	.. 73c. ..	$1·09	.. 22c. ..	$1·31
1885 . . .	2,757,844,000	.. 70c. ..	1·03	.. 16c. ..	1·19
1886 . . .	2,946,407,000	.. 70c. ..	1·06	.. 11c. ..	1·17
1887 (3 mos.)	911,415,000	.. 97c. ..	1·30	.. 10c. ..	1·40
1887 (9 mos.)	2,243,427,000	.. 67c. ..	0·97	.. 07c. ..	1·04
1888 . . .	3,209,874,000	.. 68c. ..	0·91	.. 11c. ..	1·02

This table is interesting; but, as claimed in the report, it will be found misleading, unless considered in connection with the fact that the city receives cash, at the rate of $1·50 per 1000 cubic feet, in any current year, for only about 60 per cent. of the total gas manufactured. This is shown by the following table:—

	Per Cent.
Used at works	0·79
Unaccounted for, leakage, &c.	12·87
Supplied to city for public lamps	12·35
Public buildings, schools, squares, &c.	2·30
In holders and on bills not due	12·42
Sold and paid for	59·29
Total	100·00

In connection with the manufacturing operations, we find that at the Ninth Ward works, in addition to the retorts in use for making gas, eight retorts are used exclusively for vaporizing naphtha for maintaining clear pipes throughout the works. This is stated in the report to continue to give satisfactory results; but there has been no cause found for its use at the other works. The report also refers in high terms to the value of the "iron men," concerning the use of which there has been much contention in the labour ranks at one of the works.

It is satisfactory to find from the report that the past year was the most profitable in the history of the works; and an analysis of revenue and expenditure shows that the receipts from gas alone exceeded the current outlay by only $173,556, and were not sufficient by $40,609 to pay for extensions. The actual profits were practically the sums derived from the sales of residuals. Under the contract made with the Philadelphia Gas Improvement Company, the city will have gas put into the holders for 37c. per 1000 cubic feet; calculations based upon this price, or even at the cost at which coal gas is now being made, and upon the price paid by the consumer (not taking into account the foregoing data) will, the report says, result in very disastrous financing.

The maximum capacity of the city works, with all the retorts in good condition and in operation, is 14,100,000 cubic feet per 24 hours. These figures, of course, cannot be reached in regular work, and the greatest daily output reached in 1888 was 13,191,000 cubic feet, which was on Dec. 23 and 24. This exceeded, by 370,000 cubic feet, the maximum daily output of the previous year, and required very careful management, supplemented by a fortunate combination of favourable conditions. The maximum daily consumption was reached on Dec. 24, and was 14,454,000 cubic feet; being an excess of 1,039,000 cubic feet over the corresponding date of the previous year. The daily capacity of the various works is as follows:—

Works.	Retorts.	Capacity. Cub. Ft.
Ninth Ward	991 ..	6,600,000
Twenty-first Ward	30 ..	200,000
Twenty-fifth Ward	720 ..	4,000,000
Twenty-sixth Ward.	528 ..	3,300,000
Maximum capacity		14,100,000

To this output must be added the capacity of the Philadelphia Gas Improvement Company's works, which are held in readiness to supply 8 million cubic feet of gas per day; but they can, if necessary, more than double this amount. During the past year, the storeage capacity of the works was increased by the completion of a new holder at the Fifteenth Ward station. The total holder capacity at present is given as 13,591,000 cubic feet, with a holder of 1,000,000 cubic feet capacity now in process of construction. The greatest capacity at any one station will be at the Twenty-fifth Ward works, where there will be storeage for 5 millions.

With regard to distribution and other matters, we learn that the tota length of pipe laid during last year was 208,519 feet; the principal portion being 4-inch. This is equal to 39·5 miles; and it makes the entire length of pipe in service 4,845,402 feet, or upwards of 917 miles. The illuminating power of the gas, in 1887, averaged 17·65 candles. During 1888, this average was increased to 18·54 candles. Bearing upon the quality of the gas, the report states that the continued and increased use of iron sponge in purifying, produces satisfactory results in reducing the nuisance incident to the burning of oyster shells for lime, and in the saving of money by the reduction of the number of men employed. The number of new meters introduced during the year was 4829; making a total of 122,375 meters in use. The number of services introduced were 8302; making the total in use 138,090. The lights added during the year were 111,540; making a total, as accounted for, of 2,092,539. The total number of consumers on the books of the Bureau at the close of the year was 123,427. The public lamps in use were 17,261, less 2034 which are accounted for as "not lighted," owing to their proximity to electric lamps. The amount expended for public lighting, exclusive of the gas-lamps furnished by the Bureau during the year, was as follows:—For electric arc lights, $120,134; for gasoline lamps, $131,302; for gas-lamps (Northern Liberties Company), $9429—total, $260,865. The total number of other lights, of all kinds, in addition to those furnished by the bureau, was 7103; making the total number of public lamps 24,364.

The subject of electric lighting occupies a good portion of the report Its progress during the past three years is thus given: Year 1887—524 lights, average price 54½c. per night. Year 1888—756 lights, average price 50½c. per night. Year 1889—1022 lights, average price 48½c. per night. In this connection the report states as follows: "The contracts for electric lighting call for arc lights of not less than 2000-candle power; but it is claimed that the lights furnished fall very far below these figures. The contractors say that 2000-candle power is merely a commercial term, and the lights are of the standard contracted for. In the advertisement for 1889, bidders were asked to designate by what standard their lights were to be tested; and the new contracts are made accordingly. The Chief of the Electrical Bureau is now perfecting appliances for testing these lights; and the companies will be required to comply with their contracts in the matter of candle power as well as in the number of lights supplied by them. The electric lighting by underground wires continues to give satisfactory service, notwithstanding the claims of some who, while actually lighting many lamps in this way, protest against its practicability. The Public Works Department knows of no reason, other than the first cost of the work, why all the overhead lighting wires should not or could not be placed underground. The matter of expense is one that would adjust itself were the companies engaged in this business compelled, by the adoption of proper ordinances to this effect, to remove from over the city streets this constant and ever-present source of destruction and death." The report also contains the following recommendation for the increase of the city's lighting plant:—"The amount paid for lighting the city by electricity and by gasoline is growing so rapidly that the question of pursuing this work by the city should have early consideration. There is no more reason why the city should not own one or more electric light plants than why it should not own one or more gas-works or water-works; and, with proper appropriations for such plants, the profits now made by the corporations doing the work would be saved to the city."

The report closes with the history of the installation of the new water gas plant of the Philadelphia Gas Improvement Company.

Accompanying the report of Director is one from the Chief Engineer (Mr. W. K. Park). It shows that the total production of gas last year was divided among the several works as follows:—North Ward, 1,347,738,000 cubic feet; Twenty-first Ward, 31,557,000 cubic feet; Twenty-fifth Ward, 1,016,211,000 cubic feet; Twenty-sixth Ward, 814,368,000 cubic feet—total, 3,209,874,000 cubic feet. The average daily production was 8,770,147 cubic feet. The leakage and unaccounted-for gas account amounted to 470,736,019 cubic feet, which shows an increase over 1887. This is accounted for by reference to the many breaks in mains caused by the caving-in of sewers, and to the necessary blowing out of the unusually large number of feeders laid. The coke account is given in the Chief Engineer's report, as follows:—On hand Jan. 1, 1888, 2700 bushels; made in 1888, 9,378,876 bushels—total, 9,381,576 bushels. This is accounted for thus:—Used under retorts, 3,522,634 bushels; used under boilers and in lime-kilns, 499,085 bushels; used in offices, yards, and streets, 82,246 bushels; sold, 4,641,266 bushels; breeze sold, 461,500 bushels; on hand Jan. 1, 1889, 264,845 bushels. The excess of coke on hand at the beginning of the present, as compared with the previous year, is due to the continued mild weather during the last two months of 1888, when sales were much reduced. The price of coke, which had been advanced to 7c. per bushel, was reduced to 6c. The quantity of lime and sponge used in purification, was 584,034 bushels. The use of the latter material is favourably reported upon by the Chief Engineer, as is also the working of the Ross stoking machinery.

THE ORIGIN AND USES OF PETROLEUM.

In the notices of the proceedings at the recent meeting of the British Association in Newcastle-upon-Tyne, reference was made to certain remarks of Mr. W. Anderson, M. Inst. C.E., in the course of his address to the Mechanical Science Section, on the origin and uses of petroleum. The following is the text of that portion of the address in question:—

One of the most remarkable features of the last 30 years is the introduction of petroleum, and the wonderful development to which the trade in it has attained. Under the generic name of "petroleum" are embraced a vast variety of combinations of carbon and hydrogen, each of which is distinguished by some special property. At ordinary temperatures and pressures, some are gaseous, some are liquid, and some solid; and most are capable of being modified by suitable treatment under various temperatures and pressures. The employment of petroleum in the arts is still extending rapidly. Used originally for illuminating purposes, it is now employed as fuel for heating furnaces and steam-boilers; as a working agent in heat-engines; valuable medicinal properties have been discovered in it; and as a lubricant it stands unrivalled.

As an illuminant, even in this country, it is, to a large extent, superseding every other in private houses, and even in public lamps, because it gives a cheaper and more brilliant light than ordinary gas, and leaves the consumer free from the tyranny of great and privileged companies. As fuel it is especially convenient, cleanly, and economical. Stored in tanks of suitable construction, it is sprayed into the furnace without labour and without creating dust and dirt; and it is especially convenient in locomotive and marine work, on account of the rapidity, ease, and

cleanliness with which it can be run into the tender or into the oil-bunkers of a ship. As a working agent in heat-engines, it is employed in two ways—first as a vapour, generated from the liquid petroleum contained in a boiler, very much in the same way as the vapour of water is used in an engine with surface condenser, the fuel for producing the vapour being also petroleum. Very signal success has been obtained by Mr. Yarrow and others in this mode of using mineral oil, especially for marine purposes and for engines of small power. There seems to be no doubt that by using a highly volatile spirit in the boiler, a given amount of fuel will produce double the power obtainable by other means, and at the same time the machinery will be lighter, and will occupy less space than if steam were the agent used. The other method is to inject a very fine spray of hot oil, associated with the proper quantity of air, into the cylinder of an ordinary gas-engine, and ignite it there by means of an electric spark or other suitable means. Attempts to use oil in this way date back many years; but it was not till 1888 that Messrs. Priestman Bros. exhibited at the Nottingham Show of the Royal Agricultural Society an engine which worked successfully with oil, the flashing-point of which was higher than 75° Fahr., and was therefore within the category of safe oils. The engine exhibited was very like an ordinary "Otto" gas-engine, and worked in exactly the same cycle. A pump at the side of the engine forced air into a small receiver at a few pounds pressure to the square inch. The compressed air, acting by means of a small injector, carried with it the oil in the form of fine spray, which issued into a jacketed chamber heated by the exhaust, in which the oil was vaporized. The mingled air and oil was thus raised to a temperature of about 300°; and was then drawn, with more air, into the cylinder, where, after being compressed by the return stroke of the piston, it was exploded by an electric spark, and at the end of the cycle the products of combustion were discharged into the air, after encircling the spray chamber and parting with most of their heat to the injected oil. The results of careful experiments made by Sir William Thomson and by myself on different occasions were that 1·73 lbs. of petroleum were consumed per brake horse power per hour. But the combustion was by no means perfect, for a sheet of paper held over the exhaust-pipe was soon thickly spattered with spots of oil. At the Windsor Show of the Royal Agricultural Society this year, Messrs. Priestman again exhibited improved forms of their engine. The consumption of oil fell to 1·25 lbs. per brake horse power per hour; and a sheet of paper held over the exhaust remained perfectly clean. They also showed a portable engine of very compact construction, and quite adapted to agricultural use; the ordinary water-cart, which has, in any case, to attend a portable steam-engine, being adapted to supply the water necessary to keep the working cylinder of the engine cool.

It is hardly necessary to state that the use of petroleum for furnace purposes of all kinds is increasing very rapidly, and the demand has naturally re-acted on the supply in promoting improved means of transport. Newcastle, again, has led the van in this matter; for Sir William Armstrong, Mitchell, and Co. have sent out a fleet of steamers constructed to carry the oil in bulk with perfect safety, both as regards the stowage of a cargo so eminently shifting, and with respect to risk from fire and from explosion.

The enormous consumption of petroleum and of natural gases, frequently raises the question as to the probability of the proximate exhaustion of the supply; and without doubt many fear to adopt the use of the oil from a feeling that if such use once becomes general, the demand will exceed the production, the price will rise indefinitely, and old methods of illumination and old forms of fuel will have to be reverted to. From this point of view, it is most interesting to inquire what are the probabilities of a continuous supply; and such an investigation leads at once to the question, "What is the origin of petroleum? In the year 1877 Professor Mendeleeff undertook to answer this question; and as his theory appears to be very little known, and has never been fully set forth in the English language, I trust you will forgive me for laying a matter so interesting before you.

Dr. Mendeleeff commenced his essay by the statement that most persons assume, without any special reason—excepting, perhaps, its chemical composition—that naphtha, like coal, has a vegetable origin. He combats this hypothesis; and points out, in the first place, that naphtha must have been formed in the depths of the earth. It could not have been produced on the surface, because it would have evaporated; nor over a sea bottom, because it would have floated up and been dissipated by the same means. In the next place, he shows that naphtha must have been formed beneath the very site on which it is found. It cannot have come from a distance, like so many other geological deposits, for the reasons given above—viz., that it could not be water-borne, and could not have flowed along the surface; while in the superficial sands in which it is generally found, no one has ever discovered the presence of organized matter in sufficiently large masses to have served as a source for the enormous quantity of oil and gas yielded in some districts. And hence it is most probable that it has risen from much greater depths under the influence of its own gaseous pressure, or floated up on the surface of water, with which it is so frequently associated.

The oil-bearing strata in Europe belong chiefly to the Tertiary or later geological epochs; so that it is conceivable that in these strata, or in those immediately below them, carboniferous deposits may exist and may be the sources of the oil. But in America and in Canada the oil-bearing sands are found in the Devonian and Silurian formations, which are either destitute of organic remains, or contain them in insignificant quantities. Yet if the immense masses of hydrocarbons have been produced by chemical changes in carboniferous beds, equally large masses of solid carboniferous remains must still exist. But of this there is absolutely no evidence; while cases occur in Pennsylvania where oil is obtained from the Devonian rocks underlying compact clay beds, on which rest coal-bearing strata. Had the oil been derived from the coal, it certainly would not have made its way downwards; much less would it have penetrated an impermeable stratum of clay. The conclusion arrived at is, that it is impossible to ascribe the formation of naphtha to chemical changes produced by heat and pressure in ancient organized remains.

One of the first indices to the solution of the question lies in the situation of the oil-bearing regions. They always occur in the neighbourhood of, and run parallel to, mountain ranges—as, for example, in Pennsylvania, along the Alleghanies; and in Russia, along the Caucasus. The crests of the ranges, formed originally of horizontal strata which had been forced up by internal pressure, must have been cracked and dislocated, the fissures widening outwards, while similar cracks must have been formed at the base of the ranges; but the fissures would widen downwards, and would make channels and cavities into which naphtha, formed in the depths to which the fissures descended, would rise and manifest itself, especially in localities where the surface had been sufficiently lowered by denudation or otherwise. It is in the lowest depths of these fissures that we must seek the laboratories in which the oil is formed; and once produced, it must inevitably rise to the surface, whether forced up by its own pent-up gases or vapours, or floated up by associated water. In some instances the oil penetrating or soaking through the surface layers loses its more volatile constituents by evaporation; and, in consequence, deposits of pitch, of carboniferous shales, and asphalte take place. In other cases, the oil, impregnating sands at a lower level, is often found under great pressure, and associated with forms of itself in a permanently gaseous state. This oil may be distributed widely according to the nature of the formations or the disturbances to which they have been subjected; but the presence of petroleum is not in any way connected with the geological age of the oil-bearing strata; it is simply the result of physical condition and of surface structure.

The process of the formation of petroleum seems to be the following: It is generally admitted that the crust of the earth was very thin in comparison with the diameter of the latter, and that this crust encloses soft or fluid substances, among which the carbides of iron and of other metals find a place. When, in consequence of cooling or some other cause, a fissure occurs through which a mountain range is protruded, the crust of the earth is bent, and at the foot of the hills fissures are formed; or, at any rate, the continuity of the rocky layers is disturbed, and they are rendered more or less porous, so that surface waters are able to make their way deep into the bowels of the earth, and to reach occasionally the heated deposits of metallic carbides, which may exist either in a separated condition or blended with other matter. Under such circumstances, it is easy to see what must take place. Iron, or whatever other metal may be present, forms an oxide with the oxygen of the water; hydrogen is either set free or combined with the carbon which was associated with the metal, and becomes a volatile substance—that is, naphtha. The water which had penetrated down to the incandescent mass was changed into steam, a portion of which found its way through the porous substances with which the fissures were filled, and carried with it the vapours of the newly-formed hydrocarbons; and this mixture of vapours was condensed wholly or in part as soon as it reached the cooler strata. The chemical composition of the hydrocarbons produced will depend upon the conditions of temperature and pressure under which they are formed. It is obvious that these may vary between very wide limits, and hence it is that mineral oils, mineral pitch, ozokerit, and similar products differ so greatly from each other in the relative proportions of hydrogen and carbon. I may mention that artificial petroleum has been frequently prepared by a process analogous to that described above.

Such is the theory of the distinguished philosopher, who has framed it not alone upon his wide chemical knowledge, but also upon the practical experience derived from visiting officially the principal oil-producing districts of Europe and America, from discussing the subject with able men deeply interested in the oil industry, and from collecting all available literature on the subject. It is needless to remark that Dr. Mendeleeff's views are not shared by every competent authority; nevertheless, the remarkable permanence of oil-wells, the apparently inexhaustible evolution of hydrocarbon gases in certain regions, almost forces one to believe that the hydrocarbon products must be forming as fast as they are consumed, that there is little danger of the demand ever exceeding the supply, and that there is every prospect of oil being found in almost every portion of the surface of the earth, especially in the vicinity of great geological disturbances. Improved methods of boring wells will enable greater depths to be reached; and it should be remembered that, apart from the cost of sinking a deep well, there is no extra expense in working at great depths, because the oil generally rises to the surface or near it. The extraordinary pressures, amounting to 300 lbs. per square inch, which have been measured in some wells, seem to me to yield conclusive evidence of the impermeability of the strata from under which the oil has been forced up, and tend to confirm the view that it must have been formed in regions far below any which could have contained organic remains.

GAS UNDERTAKINGS IN NEW ZEALAND.

A return has lately been presented to the New Zealand House of Representatives in reference to the number of gas undertakings in operation in the colony. The following are the prices per 1000 cubic feet charged by the Companies named:—Auckland, 7s. 6d.; Ashburton, 13s. 4d.; Christchurch, 7s. 6d.; Dunedin and Suburban, 8s.; Gisborne 13s. 4d. (if employed for heating purposes, 8s. 3d.); Greymouth, 12s. (heating, 7s. 6d.); Hokitika, 12s. 6d. and 10s.; Lyttelton, 10s. 2d. and 8s.; Napier, 10s. and 6s.; New Plymouth, 12s. 6d. and 10s.; Thames, 12s. 6d.; Timaru, 10s. 8d. and 7s. 6d.; Wellington, 7s. 6d.; Wanganui, 12s. The following are returned as owned by municipal authorities:—Blenheim, 12s. 6d. for lighting, 6s. 8d. for heating; Dunedin, 7s. 6d. and 6s. 3d.; Invercargill, 7s. 6d.; Masterton, 10s. and 9s.; Nelson, 8s. 4d. and 5s. 10d.; Oamaru, 11s. 8d. and 8s. 6d.; Westport, 10s. The capital in the various undertakings is as follows:—Auckland, £111,857; Ashburton, £8000; Christchurch, £100,900; Dunedin and Suburban, £100,000; Gisborne, £10,933; Greymouth, £10,000; Hokitika, £12,100; Lyttelton, £10,000; Napier, £17,500; New Plymouth, £8000; Thames, £18,965; Timaru, £13,000; Wellington, £80,000; Wanganui, £14,000; Blenheim, £14,000; Dunedin, £100,000; Invercargill, £45,000; Masterton, £8800; Nelson, £25,574; Oamaru, £10,000; Westport, £9000. No information was received regarding the Port Chalmers and Palmerston North Gas Companies.

Extension of the Rawmarsh Gas-Works.—The Rawmarsh Local Board have lately received tenders for the erection of gas-works for supplying their district. Those for the retort-house, &c., ranged from £2236 to £3091. The tenders were submitted to Mr. T. Newbigging, C.E., on whose certificate that of Mr. Trehern, for £2730, was accepted.

The "Shooting Incident" of the Bristol Gas Workers' Strike.—At the Bristol Police Court last Tuesday (before Messrs. Hare and Fry), Robert Young and George Browning were charged on remand with unlawfully carrying fire-arms, and with assaulting a man named Smallbridge on the previous Wednesday evening, as reported in our columns last week. On the case being re-opened, Mr. Hugh H. Gore asked the Bench to allow the prosecution to withdraw. He said they did not propose to offer any evidence, if the Bench would consent to this course being adopted. He understood that the defendants, with whom he had spoken that morning, had expressed their contrition for what had occurred, and their willingness to be bound over for three months to keep the peace. The prosecution had been prompted to this course of action in consequence of the conciliatory policy that had been adopted all round, after the unfortunate affair on the night in question. Of course, they would not have been in a position to withdraw, if it had not been for the extremely kind, thoughtful, and wise forbearance on the part of the police; but this policy having been adopted, the prosecution desired to support it. The defendants having expressed their concurrence in the proposition, they entered into their own recognizances for £5 each to keep the peace for three months.

STOCKTON AND MIDDLESBROUGH CORPORATIONS' WATER SUPPLY.

HALF-YEARLY REPORT OF THE WATER BOARD; THE PROPOSED APPLICATION FOR ADDITIONAL POWERS.

The report of the Stockton and Middlesbrough Water Board for the half year ending Aug. 13 last has been issued, together with the accounts for this period. The latter show the capital expenditure to have been £36,242 7s. 10d.; bringing up the total cost of the undertaking to £1,307,271 9s. 7d. Of the capital expenditure during the six months, the principal items are as follows:—On account of the Hury reservoir, £14,828 7s. 8d.; reservoir at Sadberge, £2536 12s. 4d.; conduit from Sadberge to Stockton, £8828 16s. 9d.; extension of mains, £4184 4s. 1d.; and land and way-leaves, £4055 8s. 5d. The sums received on capital account during the half year amounted to £24,710 3s. 6d.; bringing the total up to £1,303,604 4s. 5d., or £3467 5s. 2d. short of the amount expended. The revenue account shows the income to have been £29,846 16s. 4d.; being an increase of £1099 9s. 7d. as compared with the preceding half year, and of £1499 14s. 1d. as compared with the six months ending Aug. 13, 1888. The expenditure on revenue account was £6515 8s. 1d.; being a decrease of £365 1s. 10d. as compared with the preceding half year, and of £188 11s. 1d. in comparison with the corresponding period of 1888. The balance carried to the net revenue account is £23,331 8s. 3d., as compared with £21,876 16s. 10d. in the previous six months, and £21,643 3s. 1d. in 1888. The net revenue account shows a balance of £29,973 19s. 5d., including £6743 13s. 8d. brought forward from the previous half year. Out of this sum £24,000 has been paid to the several authorities owning the undertaking; leaving £5973 19s. 5d. Cheques amounting to £4800 will be handed to them, and the balance of £1173 19s. 5d. carried forward. Since the last report, the Sadberge reservoir has been brought into use. The works in connection with Hury reservoir make satisfactory progress; the main embankment being now within 9 feet of the finished level. A contract for the construction of the Blackton reservoir has been entered into, and a commencement made with the work. During the half year, the villages of Long Newton and Elton have been supplied with water, and arrangements have been entered into for extending the Board's mains to the villages of Billingham and Egglescliffe and to the Carlton Iron-Works. In view of the rapid growth of the demand for water for manufacturing purposes and the daily extending area supplied, the Board have determined that it will be prudent immediately to press on with the construction of the gravitation main authorized by the Act of 1876, and tenders are now being invited for the pipes required to deliver the Hury water into the Sadberge reservoir. As already stated in the JOURNAL, the Board have had under consideration the advisability of applying to Parliament in the ensuing session for additional powers; and at a private meeting recently held a memorandum was read and considered with reference thereto. It is proposed, first, to alter section 3 of the Board's Act of 1888 so as to extend the time for the completion of the following works:—(1) The Blackton reservoir to Dec. 31, 1896—*i.e.*, two years; (2) The Grassholme reservoir and conduit No. 1 to Dec. 31, 1910—*i.e.*, 16 years; (3) conduits Nos. 3 and 4, so far as they apply to a second line of pipes, to Dec. 31, 1910—*i.e.*, 16 years; (4) to revise such of the compulsory powers to take land that may be considered necessary, and to extend them if deemed advisable; (5) to alter section 5 of the Act of 1888 so that the 66 million gallons mentioned in the section shall be 70 million gallons; (6) to increase the borrowing powers of the Stockton and Middlesbrough Corporations and the South Stockton Local Board by £382,385; (7) if thought necessary, to authorize certain deviations from the parliamentary line of 1876, of parts of the gravitation made; (8) to repeal certain parts of section 54 of the Act of 1876 relating to fish passes; (9) to amend section 84 of the Act of 1876 so as to make compulsory the provision of suitable cisterns in houses where there is a bath or water-closet; (10) to provide a set of rules and regulations as to water supply, plumbing, &c.; (11) power for the Board to exchange lands; and (12) alteration of section 4 of the Act of 1876 as to the purchase of pipes. After some discussion, the Board directed that a rough draft of the Bill, drawn in accordance with the memorandum, should be prepared and laid before the members.

THE WATER SUPPLY ARRANGEMENTS AT THE PARIS EXHIBITION.

The arrangements for affording an adequate supply of water to the Paris Exhibition are not less remarkable than the other features of that great undertaking, the brilliant career of which is now fast drawing to a close. They were necessarily on a large scale; and they were satisfactorily carried out by M. Bechmann, Engineer-in-Chief of the Water Department of the Municipality. A description of the works was given in a recent number of *Engineering*, from which the following particulars are extracted; and as many of our readers have visited the Exhibition, they may possibly prove interesting.

For general requirements there are three distinct systems by which the water for service is led to the points where it is to be used—viz., the river water at low pressure, for watering the parks and gardens; the river water at high pressure, for sprinkling the interior of the exhibition, for the fire service, and for subscribers; the spring water system for the restaurants, cafés, &c.

The service for mechanical requirements consists of a distributing-main from a reservoir situated on the Quai d'Orsay at the corner of the Avenue de Suffren, kept supplied by pumping machinery on the edge of the Seine, which conveys water to the Machinery Hall and its annexes for the production of steam, condensing, and other purposes. In addition to this there is a special discharge main for taking off the hot condensing water into the Seine, the temperature being too high to allow of its being turned into the sewers.

The most important of the three systems of general service-mains, which comprises the supply of river water at high pressure, consists of a main branching from the 31-inch pipe laid under the Boulevard de Grenelle that brings the Seine water from the reservoir of Villejuif, of two distributing-mains forming a complete circuit, and of two auxiliary mains by means of which, in case of accident, the Seine water from the Villejuif reservoir can be replaced by that coming from the main in the Quai d'Orsay connected with the Mont Rouge reservoir. The principal main, the diameter of which is 23·62 inches, leaves the Villejuif main on the right of the Avenue de la Motte Picquet, follows this avenue, passing in front of the Machinery Hall on the Avenue de Suffren side, and runs along the whole length of the centre space, which is between the Machinery Hall and the Industrial Courts. The two service-mains, each 11·81 inches in diameter, quit the principal line to follow the sewers beneath the buildings devoted to the Fine Arts and the Liberal Arts, and join again at the foot of the Eiffel Tower. It is at this point that they are connected with the auxiliary main, 19·69 inches in diameter, which is a branch of the 24-inch main of the Quai d'Orsay. The junction is made near the left abutment of the Pont d'Iéna. At the foot of the tower, and to the junction of the 11·81-inch main, is attached a branch 9·84 inches in diameter to supply the ornamental basins and the fountain. The other auxiliary pipe, 15·75 inches in diameter, which brings in case of necessity, the spring water to the first system of pipes, is connected to the main of the same diameter beneath the Avenue de la Bourdonnais. It is this main which, under ordinary conditions, supplies the spring water service. To effect this, a little in front of the valve connecting the large high-pressure river water-main, a branch 7·87 inches in diameter leaves the main diagonally, and divides a little farther on into two branches, each 5·90 inches in diameter. These follow the same circuit as the 11·81-inch mains carrying the high-pressure river water. The third system receives its supply of low-pressure river water from the Grenelle reservoir, through a pipe 15·75 inches in diameter, which runs as far as the Avenue de Suffren near the Quai d'Orsay. This third system consists of a principal main 11·81 inches in diameter, which commences at the extremity of the 15·75-inch pipe, and runs parallel to the Seine as far as the axial sewer of the Champ de Mars. Beyond this the main continues, but with a diameter reduced to 9·84 inches, and runs as far as the mains of the Ourcq system of water supply, which are also 9·84 inches in diameter. By this connection, a second source of supply is made available in case of necessity. At the point where the pipe crosses the sewer, a branch 5·90 inches in diameter follows the course of the sewer, and numerous service-pipes are taken from it to furnish the water necessary for the gardens, &c. By means of a connection with the system of high-pressure mains, the water from the Villejuif reservoir can be substituted, when required, for the ordinary low-pressure supply. The three services are completed by numerous branch-pipes varying in diameter from 2·5 to 7·8 inches in diameter.

The main which furnishes the water for steam production, condensing, &c., from the temporary station on the Quai d'Orsay, is 23·62 inches in diameter; and is capable of delivering a total quantity of 1¼ million gallons per day. It is placed beneath the pavement on the left side of the Avenue de Suffren as far as the Machinery Hall, where it is turned almost at right angles, and runs down the whole length of the gallery, in a subway constructed for the purpose. Towards the centre of that part of the building devoted to the foreign exhibits, a branch 15·75 inches in diameter is taken off, and this also runs through a gallery. The same course is taken by the waste-water mains, which are of similar diameters. Advantage is taken of the natural slope of the ground to give such a fall to the latter mains that they may at all times carry off more water than the supply-pipes can deliver.

In addition to the system just described, there is another pipe-line 23·62 inches in diameter, which brings the water from the lower basin of the Trocadero fountain to the monumental fountain of the Champ de Mars. This water, after having been used on the higher ground of the Trocadero, serves for a second time, but only during the day, to produce the low-pressure jets within the ornamental water of the gardens. This main passes beneath one of the footpaths of the Pont d'Iéna, where it forms a junction of the auxiliary high-pressure main; making use of this latter for a considerable distance, and then turning off to the fountains.

To summarize the foregoing remarks, the water service on the Champ de Mars is divided into the following system:—(1) Water taken from the Seine and delivered at high pressure. (2) Water taken from the Seine and delivered at low pressure. (3) The spring water supply. (4) Seine water for the Machinery Hall. (5) Discharge-mains for condensing water, &c. To complete these various systems, the following diameters and lengths of pipes have been laid:—23·62-inch, 4420 metres; 19·69-inch, 290 metres; 15·75-inch, 700 metres; 11·81-inch, 3650 metres; 9·84-inch, 835 metres; 7·87-inch, 1175 metres; 5·90-inch, 3120 metres; 3·94-inch, 5070 metres; 2·36 inch, 3430 metres—making a total of 22,690 metres, or about 14 miles. In addition to the foregoing, there are about 6500 feet of mains 3·39 inches in diameter that were laid in the Trocadero in 1878.

The sprinkling of the interior of the buildings and the fire service are ensured by 155 standpipes, provided with hose and nozzles. In addition to which there are 15 standpipes arranged for coupling on the hose of steam fire-engines; and there are nine drinking fountains.

The system of mains is controlled by 113 valves, and the total consumption of high-pressure water per day exceeds 1¾ million gallons. The water required for the grounds is not reckoned, as it is supplied gratuitously by the City.

UXBRIDGE WATER SUPPLY.—A recent outbreak of diphtheria at Uxbridge has drawn attention to the water supply; and the Local Board are of opinion that this was the original cause of the mischief. At a recent meeting of this body, a letter was read from a person who was Clerk of the Works when the water-pipes in the district were laid down some 30 years ago. In it he stated that the materials were reckoned to last 20 years only; and therefore a great portion of the pipes would by this time require renewing. He pointed out that the method of laying adopted facilitated contamination. There is to be a Local Government Board inquiry on the subject, when all the facts will be investigated.

THE UNSANITARY CONDITION OF SUTTON (HULL).—The condition of the village of Sutton, near Hull, has lately been engaging the attention of the Rural Sanitary Authority of the Sculcoates Union, owing to a serious outbreak of fever which has recently occurred there, attributed mainly to the use of contaminated water. The supply is drawn from wells, the water in some of which has been analyzed, and found to contain a large quantity of albumenoid ammonia. It seems that the village has been unhealthy for years; and both the water supply and drainage require radical alteration. Steps are being taken to improve the drainage; and a proposition is on foot to ask the Hull Corporation to furnish a service of water from their mains, which run close up to the village.

THE GAS SUPPLY OF BIRKENSHAW.—The members of the Birkenshaw Local Board have lately visited the Leeds Forge, and have returned with the impression that the water gas there manufactured is better than the coal gas made by the Leeds Corporation. The subject was introduced at the meeting of the Board last Thursday by Mr. Crowther, who said he was prepared to move that the Clerk should communicate with the Gomersal Gas Company (with whom the Board had then some disagreement as to the price of gas for lighting purposes), asking if they were prepared to sell to the Board their plant and the rights and privileges they hold in the Birkenshaw district, and also to inquire the terms on which they were prepared to sell, if at all. He thought that all local authorities should possess gas-works, and that it was desirable the Board should secure plant either partially from the Company or elsewhere, whether it cost more or less. The proposition was carried. The subject of public lighting was then introduced; a ratepayers' representative attending the meeting to ask if the streets could not be lit during the coming winter. The Chairman (Mr. Pitt) said the Board would be willing to light the streets, but they were fettered by a resolution passed at a meeting of ratepayers. The Gomersal Gas Company had informed the Board that, when they reduced the price of gas, the consumption fell off. They decided to increase the charge 3d. per 1000 cubic feet; and on this being reported to the meeting, they decided that there should be "no light without some concession." In the course of conversation, it was stated that public opinion had changed since the meeting; and it is possible some steps wil be taken to light the streets.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

EDINBURGH, *Saturday*.

The agitation among gas workers has broken out in this quarter. During the whole of the year there has been a continuous effort to reach bodies of working men by members of the Trades' Council, with a view to organizing them into a position to assert their claims for shorter hours and higher wages. When the difficulty occurred with the Leith gas stokers last winter, the Trades' Council did what it could to back up the contention of the men. On that occasion, the Gas Commissioners admitted that there was a grievance to the extent that the men at Leith were paid lower wages than those in the Edinburgh works; and they conceded the advance, but did it in such a way as to leave a sore behind, inasmuch as they, having taken on fresh men, kept them, and declined to take back some of the men who had gone out on strike. There was something to be said on both sides, because the Commissioners having taken on these fresh men, had entered into an engagement for one month with them; and, as a matter of course, could not part at once with them. On the other hand, the men who admittedly had been working under a grievance, saw that their action had succeeded in securing better terms, but found themselves excluded from enjoying them. To be sure, it was the hasty manner in which they came out on strike which drove the Commissioners to take the protective step of the monthly engagement with the new hands, so that the Commissioners had the greatest show of right upon their side. The movement, however, under the fostering hand of the Trades' Council, resulted in the formation of a Gas Workers' Protective Association. That body once in existence, it was a natural consequence that now, with the narrative of the doings at Bristol ringing in their ears, it should be put in action. Accordingly a meeting of the gas workers in Edinburgh and Leith was held in Edinburgh on Wednesday night, to consider "what steps should be taken to improve their present unsatisfactory condition." About 100 men attended. Mr. John Mackenzie (a member of the Trades' Council, and Vice-President of the Association) presided. He said the object of the meeting was of a twofold nature—first, to ask those not already connected with the Association to become members; and, secondly, to take steps with the view of approaching the employers to remedy any grievances under which the workmen might be labouring. He understood they had a considerable grievance in regard to Sunday labour; and he urged the necessity and importance of working men being combined in any action that might be adopted in the way of bettering their position. The Secretary (Mr. J. B. Herriot) spoke in a similar way. He did not think the gas workers were sufficiently paid for their labour, any more than he was; and so long as they were divided, and employers of labour knew that, they (the employers) would crush them. Mr. Thomas Blaikie (Treasurer of the Trades' Council and Treasurer of the Association) further adverted to the desirableness of organization as the first step towards any improvement in the condition of the workmen. Unless they were prepared to make a demand, and that in a body, they need never expect to get that justice to which they were entitled. He counselled the men not to do anything rashly, but to be determined in what they did to reach the goal aimed at. Mr. Andrew Nairn (a member of the Trades' Council) also briefly addressed the meeting. Like preceding speakers, he referred to the value of union in the event of a redress of grievances being sought. After expressions of opinion had been given as to the present conditions of labour, it was resolved, in the case of the carbonizing department (retort men and barrow men) to request an increase of wages of 1d. per hour (making the remuneration 5s. a day), and that for yard men an advance of ½d. per hour be asked, and time-and-a-half for all overtime, Sunday included. It was agreed to embody the terms of the resolution in a memorial to be submitted to the Gas Commissioners. These demands are a little in advance of what has been given at Bristol, notably the time-and-a-half on Sundays. At present the retort men work 51 hours per week, and receive 6½d. per hour. They ask 7½d., which would raise their wages from 27s. 7d. to 30s. per week, for ordinary time, and about 32s. when employed on Sunday. The time for making their demand—just before the municipal elections—has been well chosen by the men, because they will be better able to coerce the councillors who are standing for re-election, into yielding. On that account, the Commissioners are put rather into a box. If any of their number, in order to secure the votes of working men, should, on the platform, agree to grant the men's demands, their action would probably be resented by the sitting members, and a split would take place in the Commission, which would strengthen the hands of the men. If the Commissioners should reject the men's demands, a strike would be attempted, which they would have difficulty in fighting at this awkward season. On the other hand, if they should grant them, they would earn the reprobation of all employers of labour in the city, for setting a bad example in giving way. They have a difficult task in front of them; and I hope they will be able to pilot themselves out of it without getting into any of the serious positions which, looking forward, I have here foreshadowed.

At Monday's meeting of the Perth Gas Commissioners, the question of wages at the gas-works came up, and led to a discussion an hour and a half in length. In their case, however, the question was not started by the workmen, but arose within their own body. So far back as March last, the Works Committee considered that the wages of the man who was originally employed as mason in the works, but who has latterly been virtually acting as assistant manager, were too low at 32s. per week. The Committee recommended an increase of 3s. per week; but at the April meeting of the Commission this was considered to be still insufficient, and the question was sent back to the Committee to reconsider. Meantime, a Ratepayers' Association had been formed in the city, to endeavour to keep down public expenditure; and they took up the question with some heat when the Works Committee recommended that this man should be appointed assistant manager, and that his wages should be 40s. per week. The report of the Committee to that effect came before the Commission on Monday; and it also contained the recommendation that increases at the rate of 1s. 6d. per week be given to retort men, and 1s. per week to labourers, that any new men to be engaged should be paid at the rate of 24s. 6d. and 20s. respectively, and that the gas-fitters' wages be raised by 2s. per week, making them 31s. for foremen and 22s. for workmen. These are still very moderate wages; but the Ratepayers' Association were dissatisfied, and their spokesmen in the Commission took exception to the proposed increase to the assistant manager. The result of the discussion was that all the recommendations of the Committee were adopted by 13 votes to 5.

The excitement in Banff over the supposed defective condition of the Gas Company's plant, has been allayed by the report of Mr. A. Smith, of Aberdeen, published in my "Notes" of the 1st inst. Mr. Smith's report was laid before the Public Commissioners on Monday; and the Provost, who was formerly very severe upon the Gas Company, expressed his satisfaction at the state of matters. This is all very well; but what have the Gas Company, now that their position has been established, to say to the most arbitrary proceeding on the part of the Town Clerk, of ordering the gas supply to be cut off for one day? Are they to meekly submit to such a high-handed proceeding, for which, I believe, there is no precedent?

Lord Kinnear, in the Court of Session, on Thursday disposed of an action which was raised against the Police Commissioners of Dunbar by John Mackay, contractor, Hartington Place, Viewforth, Edinburgh. Pursuer sued for £334 16s. 11d., said to be due to him for work in connection with the recent extension of the Dunbar Water-Works. The contract price was £1630 6s. 10d.; but Mackay said he executed additional work for which he had not been paid, and that he had only received £1500 of the contract price. In defence it was stated that the works should have been finished by Sept. 1, 1888, but were not completed until the 15th; and the Commissioners also averred that the work was defective. His Lordship last session remitted the question to Mr. Breliner, C.E., Edinburgh, who has now reported; and, in terms of his report, decree was given for £172 17s. 6d. A long discussion took place upon the question of expenses, which are heavy; and his Lordship found neither party entitled to them.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday*.

Provost Babtie, who has been the Chief Magistrate of the Burgh of Dumbarton, and for upwards of twenty years in the Town Council, lately expressed his desire to retire from office; but as his constituents and the townspeople generally wish him to return to the Council, with the view of remaining at the helm of municipal affairs, he has consented to allow himself to be again nominated for a seat in this body. Accordingly, he appeared before the electors of the Fourth Ward on Wednesday evening; and in the course of his remarks to them, he gave some prominence to the gas affairs of the town. Being, he said, Convener of the Gas Committee, he had taken a deep interest in the Gas Department of the Corporation. The gas-works had been doubled in size within the last six years; and now it was necessary to erect a retort-house; but that only showed the prosperity of the town. The gas altogether had been a most excellent and profitable thing for the community. During the last ten years it had subsidized the Pier to the extent of £9921, and the Common Good to the extent of £745. Although these large sums had been taken from gas profits, the price of gas had been steadily reduced all along. Ten years ago it was 4s. 7d. per 1000 cubic feet; and now it was 3s. 3d. He put it to his hearers whether or not the gas undertaking had been well and profitably managed in the interest of the community; and his question was received with loud applause.

The local gas supply undertaking has again been the subject of remark at the Greenock municipal election meetings this week. At one meeting, Mr. James Lang, jun., made reference to the subject; and subsequently at the "heckling" stage of the proceedings his two colleagues were asked by an elector if they were prepared to support Mr. Lang in his endeavours to sell gas at wholesale price. This question led him to explain that he did not mean anything particular by wholesale price. His meaning was that they should pay a price at which gas could be produced after paying all interest on borrowed money, sinking fund, and working expenses; and his two colleagues promised to give the matter their careful consideration. At the meeting of the Seventh Ward, Bailie Ramsay, speaking on gas matters, said that he did not know if everybody was aware that, while the amount of capital borrowed in connection with the Gas Trust was £150,000, there had already been repaid of that sum £38,000. At this rate of payment, the entire sum might be expected to disappear within possibly fifteen years, and then their whole gas system, with its large surpluses, would be a free asset to the ratepayers. Following up this line of remark a little, Bailie Ramsay said that the same thing held good, but to a lesser extent, with the Water Trust. The total sum borrowed was £415,000; and of this there had been repaid £60,000. So, with the excellent prospect of cheaper gas and water in years to come, they had the prospect also of leaving a comfortable inheritance to their children if they chose to remain in the town.

At one of the Kilmarnock municipal ward meetings, held early in the present week, the Convener of the Gas Committee had something to say regarding the work of the Corporation Gas Department. They had, he said, been doing their very best to improve the works. Within the last four years they had expended in improvements no less a sum than £3000; and during the same period they had paid off mortgage bonds to the extent of £7000. Besides this the price of gas had been lowered to something like 3s. 6d. per 1000 feet. They had telescoped one of the old gasholders, to their great advantage. Then they had to extend the retort-house, because there was not sufficient room to make gas as required. They also put in new coal-sheds around the retort-house, which made it comfortable for the men, and dry for the coals. In one of the corners they had managed to get a room for the men, so that they could wash themselves, or have a bath, and go home comfortably. Treasurer Ferguson, in delivering his valedictory address to the electors of the Fifth Ward in the same town on Monday evening, mentioned some very interesting particulars regarding the Kilmarnock gas supply undertaking. His predecessor in office, Treasurer Reyburn, when taking farewell of his constituents at the close of a long and honourable career three years ago, had given an excellent review of Corporation work for fifteen years; and in referring to the gas-works, he stated that they were acquired in the year 1872, at a cost of £40,500, to which had to be added £2000, being the proportion of the cost of the local assessment charged against the undertaking. Against this had to be borrowed the sum of £44,500, which sum, in 1886, when Mr. Reyburn left, had been reduced to £36,500, in addition to which a large amount had been taken from revenue to pay for extensions of works and extraordinary repairs. He had further stated that he would have liked to be able to pay off £1000 annually; but, the Committee not taking the same view, he had to be content with laying aside £660. During the three years which had elapsed since Mr. Reyburn made that statement, there had been paid off no less a sum than £6500—within £1500 of the amount cleared off in the previous fourteen or fifteen years. This made for the last three years an average of £2166 13s. 4d., thus reducing the indebtedness of the Corporation in the Gas Department from £36,525 in 1886, to £30,025 now, besides having paid some £1700 for extensions and extraordinary repairs out of revenue—while in 1886 the price of the gas was reduced to 3s. 6½d. per 1000 cubic feet. The relative prices since the works came into the hands of the Corporation had been:—1872-4, 5s. 10d. per 1000 feet; 1875-7, 5s.; 1878-81, 4s. 7d.; 1882-4, 4s. 2d.; 1885-7, 3s. 11½d.; and 1888-9, 3s. 6d. per 1000 feet. The indebtedness of the Gas Corporation was reduced last year to the extent of no less than £3000, which was included in the £6500 already referred to. No mortgages become due this next year; but Treasurer Ferguson expected that his successor would have sufficient laid aside by the following year to make a further substantial reduction in the price of gas. Mr. Smith, addressing the same meeting, said there was no doubt that a considerable sum had been paid off the liability of the gas-works in recent years; and the electors ought to congratulate the Gas Committee who at various times had had charge of the works, and they must not forget the gentlemen, such as Mr. Kennedy, Mr. M'Culloch, and several others, who, out of their engineering experience, were able to originate and carry out to a large extent the improvements the benefit of which was now being reaped. His hearers would also observe, he said, that the growth of the electric light within the last two or three years had been considerable; and they, as a

Corporation, were bound to keep this in view, so that at the very earliest possible date they might get their liabilities down to within the sum that they were able to assess for, and then they would be perfectly independent, or at least to a certain extent independent, of the electric light, because they would be able to borrow on the best terms, as they would be in a position to offer the people from whom they were borrowing the security of their powers to levy rates to the extent of 3d. per £1, and that would pay interest on £28,000 at the present time, so that they were nearly down to what they might call their normal standing.

Mr. Alexander Brown, late Gas Manager at Dalry (Ayrshire), died at his residence in Dalry last Thursday morning, after a short illness.

Messrs. Hanna, Donald, and Wilson, gas engineers, Paisley, have secured the contract for the construction of a gasholder which is to be built in connection with the extensions now being made at the chemical works, Kilbowie.

Yesterday the Glasgow Corporation 9 per cent. gas annuities changed hands at £288—no alteration from the last transaction. The ordinary shares of the Partick, Hillhead, and Maryhill Gas Company were sold at £5 7s. 6d. and £5 5s. per share; and the preference shares were quoted at £5 13s. 9d. per share.

The Glasgow pig-iron warrant market has been very excited this week, and the highest prices of the year have been paid by buyers. On Tuesday and Wednesday enormous realizations took place, and it seemed as if the market would give way; but all the warrants offered have been steadily absorbed, and the week finishes with quotations at near the best points. A great deal of the operating is on English order; and the warrants appear to be going into strong hands. General business is healthy and is expanding; and well-informed circles look for yet a higher level being reached.

As an evidence of the healthy condition of the local coal trade, it may be mentioned that prices are from 2s. to 2s. 6d. per ton higher than they were at this time last year; and they are still on the ascending scale. The demand for house coal is broadening out very considerably.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 19.

Sulphate of Ammonia.—The market is without change. The highest price obtainable at the various ports has been £11 17s. 6d.; while transactions at 1s. 3d. to 2s. 6d. per ton less have been reported. A steady feeling prevails, however; and a decline does not for the moment seem imminent. There is very little offering for future delivery; makers being generally unwilling to contract ahead. But some speculative business has been passing at fairly good prices. At the close, there is a good inquiry for spring delivery. The nitrate market is steadier also, notwithstanding the heavy arrivals during the first half of October—over 50,000 tons.

LONDON, *Oct.* 19.

Tar Products.—In anthracene, oils, and other products (excepting pitch), there has not been much fluctuation; but speculative operations in pitch have run the price up several shillings per ton. It remains to be seen whether the present values can be maintained. Benzols are steady, and will no doubt before long share in the general improvement. Prices: Pitch, 25s. to 32s. 6d. per ton. Tar, 26s. to 32s. per ton, according to position. Benzol (90 per cent.), 3s. 2d. per gallon; (50 per cent.), 2s. 3d. per gallon. Toluol, 1s. 6d. per gallon. Solvent naphtha, 1s. 7d. to 1s. 9d. per gallon. Crude naphtha (30 per cent.), 1s. 2d. per gallon. Light oil, 4d. per gallon. Creosote, 2¼d. per gallon. Carbolic acid (60's), 3s. 5d. to 3s. 6d. per gallon. Cresylic acid, 10d. per gallon. Anthracene (30 per cent.), "A" quality, 1s. 1d. to 1s. 1½d. per unit; "B" quality, 11½d. to 1s. per unit.

Ammonia Products.—Sulphate of ammonia stands at £11 17s. 6d.; but as nitrate of soda is moving upwards for forward delivery, it will no doubt in due course affect the value of sulphate. Prices: Gas liquor (5° Twaddel), 7s. to 8s. per ton, with a rise or fall of 1s. 6d. per degree. Liquor ammonia, 1¾d. per lb. Carbonate of ammonia, 3½d. per lb. Muriate of ammonia, brown, £22 per ton; white, £29 per ton. Salammoniac, £34 to £36 per ton.

THE ASHTON-UNDER-LYNE GAS COMPANY AND THE PRICE OF GAS.—Writing to a local paper to advocate a reduction in the price of gas, Mr. W. Moss, a local Accountant, says the accounts of the Ashton-under-Lyne Gas Company for the year ended June 30, 1889, show that £8942 14s. 7d. was the profit made on revenue account, besides which £476 18s. 9d. was received as interest on reserve funds invested, making a gross profit of £9419 13s. 4d. With the price of gas at 2s. 4d. per 1000 cubic feet (the present rate), the shareholders are entitled to a dividend of 14 per cent. This on a share capital of £52,680, amounts to £7375 4s.; leaving a surplus on the year of £2044 9s. 4d. Last year's consumption of gas was 205,100,731 cubic feet; and to reduce the price of gas 1d. and pay the increased dividend of ¾ per cent. to which the shareholders would be entitled, would take £986 5s. 8d. On the basis of the present balance-sheet, the price could, therefore, he contends, be reduced 2d. per 1000 cubic feet. He states that, owing to the fall in the value of residuals, the Company have for some years past had to draw on the accumulated profits to maintain the dividend; but he holds that, now that the accounts show a clear balance in favour of a reduction, the question ought to be raised. The Company's total reserve funds amount to £22,603 8s. 3d. Of this £10,083 8s. 3d. is the balance to the credit of the profit and loss account on June 30 last, after deducting the last half-year's dividend; £9000 is the invested reserve fund; and £3520 is the total of the insurance fund, which is also invested.

THE PRICE OF GAS AT BROUGH AND ELLOUGHTON.—A meeting of gas consumers was held in the school-room Elloughton, last Thursday evening, to consider the attitude of the Brough, Elloughton, and District Gas Company respecting the consumers' demands for a reduction in price. Mr. W. A. Massey presided, and explained that the meeting was the result of the reply to a requisition sent to the Company. The Board had, he believed, offered to reduce the price of gas from 5s. 8d. to 5s. per 1000 cubic feet, and also to charge at the rate of 4s. per 1000 feet for gas used for cooking and motive power purposes. There seemed to be a very general opinion that a reduction to 5s., although much appreciated, was not one that would be acceptable throughout the whole district. Mr. England thought they should adhere to their first request for a reduction to 4s. 6d., especially as neighbouring villages were only paying 3s. 6d. They considered even 4s. 6d. a heavy rate. He moved—"That this meeting, whilst recognizing the conciliatory spirit of the Board of the Gas Company in reducing the price of gas to 5s. per 1000 feet, is yet of opinion that a satisfactory concession in price has not been made, and hereby respectfully requests the Directors to reconsider their decision, in order to arrive at a fair compromise by reducing the price to 4s. 8d. per 1000; the reduction to date from the 1st of January next, at which date the consumers promise to use their influence to further extend the consumption of gas in the district." If the Directors did not agree to this, he was prepared to adopt oil. The motion was carried unanimously.

THE TODMORDEN LOCAL BOARD AND THE WATER SUPPLY.—Arrangements have been made for a meeting of the ratepayers of Todmorden during the present month to consider a proposal by the Local Board to acquire the water undertaking. At a meeting of the Board last Wednesday, it was stated that the proposed termswere that the Board shall pay not less than the actual sum expended by the Company.

SALE OF STOCK IN THE MAIDSTONE GAS COMPANY.—The following shares in the Maidstone Gas Company have lately changed hands:—Two lots of £50 consolidated stock, the dividend paid up to the 1st of July last being at the rate of 10½ per cent. per annum, were sold at £125 each; a similar lot for £120; and two other lots for £123. Three lots of £25 stock realized £59 each. In addition to the above, the following stock has also changed hands:—Parcels of £50 consolidated stock for £118 and £121; £60 do. for £141. Two other lots of £50 stock have been disposed of at £119 and £120 respectively.

PROJECTED EXTENSION OF THE MID-KENT COMPANY'S WATER SUPPLY.—At a meeting of the Malling Highway Board last Friday, Colonel Holland said the Chairman of the Mid-Kent Water Company had informed him that the Company intended applying to Parliament for powers to extend their mains throughout the parishes of that Union, and were willing to supply Burham, Eccles, Wouldham, Mereworth, and other places, if they had the support of the Authority. He said it was desirable, on sanitary grounds, that a good and proper supply of water should be furnished throughout the district; and it was resolved to support the scheme, and send notification thereof to the Local Government Board.

THE VYRNWY WORKS.—At the meeting of the Executive Water Sub-Committee of the Liverpool Corporation on the 7th inst., Mr. George F. Deacon, the Engineer, reported that the works connected with the construction of the tunnel under the Mersey were now progressing satisfactorily. The contractor had in use two compressed-air machines; and the excavation and building operations were being proceeded with much more speedily than was possible before the additional machine was employed. This tunnel has been the cause of considerable trouble and anxiety to the Engineer; but it is believed that, with the present arrangements, there will be no further difficulty. All the works are being rapidly pushed forward; and, unless a serious accident happen to upset the Engineer's calculations, the aqueduct will be completed at an early period, and a good supply of water be obtainable from the Vyrnwy lake. With the recent heavy rainfall, the volume of water in the lake has been largely increased, and is within 7 feet of the top of the masonry dam.

FYLDE WATER COMPANY.—The Directors of this Company, in their 55th half-yearly report, state that the capital account was increased during the half year ending Aug. 31 last by an expenditure of £3972, and now amounts to £239,921. The revenue account shows that the water-rates and other receipts during the half year (including £1338 18s. 10d., the balance brought forward) amounted to £12,944 12s. 8d., less empty houses £496 19s. 3d., and bad debts £20 17s.—total, £12,476 16s. 5d. Deducting interest on loans and bank commission, £1094 14s. 11d., sinking fund account, £250; and working expenses, rates, rents, and taxes, £2535 2s. 1d.; there was left a balance of £8596 19s. 5d. The number of consumers increased during the half year by 222, and is now 10,409. The Directors recommend a dividend at the rate of 6¾ per cent. per annum, free of income-tax; leaving a balance of about £2680. Of this amount, they recommend £1000 to be added to the reserve, making that fund £8500, and the remaining sum of £1680 to be carried to the next account.

THE UNSIGHTLY ELECTRIC LIGHTING POLES AT WEYBRIDGE.—Last Saturday week a largely-attended meeting of ratepayers was held at Weybridge, to consider what steps should be taken in regard to the "unsightly poles" which are now being erected for the purpose of carrying out a scheme of electric lighting in the parish. The work is being done by contractors under authority from the Lighting Inspectors; and, apart from the "pole" question, doubts have been raised as to the power of these gentlemen to grant such authority. It is generally acknowledged that the poles interfere very seriously with the picturesqueness of the locality, and therefore their retention will be detrimental to it for residential purposes. The Inspectors themselves admit the unsightliness of the posts; but they say they had not sufficient money to place the wires underground. The outcome of the meeting was the appointment of a Committee "to confer with the Inspectors as to making some arrangements for the public lighting of the parish, which may be free from the objections of the present scheme." A conference took place last Tuesday; but the result has not been made known. In the meantime, the contractors are proceeding with the erection of the poles in accordance with their contract.

THE QUALITY OF BRISTOL GAS.—The extraordinary proceedings which were witnessed in Bristol on the occasion of the recent strike have been the subject of much letter-writing in the local papers; and not only has the mismanagement of the whole business been freely criticized, but the opportunity has been taken of condemning the quality of the Company's gas. This is a long-standing grievance; and it was brought forward at the meeting of the Urban Sanitary Authority on the 8th inst., as already reported in the JOURNAL, and again last Thursday. It was explained on each occasion that, according to the reports of the Corporation's own Gas Examiner (Mr. B. Kitt), the gas was up to the standard. In view of the present complaints, it may be of interest to give some extracts from that gentleman's report for the quarter ending Sept. 30 last. With regard to illuminating power, he says the average was 14·83 candles; the highest being 16·16, and the lowest 14·50 candles. He states that during his experiments he frequently noticed that the volume of the gas altered in quality—being rich one hour and poorer the next; but in no case was it below the standard of 13·50 candles. He explains that this variation is caused by the system of manufacture adopted. The pressure was always above the standard; the highest being 3·1 inches, and the lowest 1·2 inches.

THE DRAINAGE OF MARGATE.—An important stage in the sewerage scheme which is to be carried out at Margate from the designs of Mr. Baldwin Latham, M. Inst. C.E., to which reference has already been made in our columns, was commenced last Thursday, when the Mayor (Mr. W. Leach Lewis) laid the foundation stone of the central pumping-station at Tivoli. From this point the power is to be transmitted to the other pumping-stations by means of a hydraulic main. The sewage tunnel, 70 feet deep, in the chalk rock, runs from the Cliftonville end of Margate by the eastern esplanade; and the works provide for a continuous flow of sewage from the town, though there are about two hours at each tide when there will not be an actual discharge into the sea. As the sewage will only be delivered when the tide is flowing away from Margate, there can be no ground for apprehension that it will be returned upon the shore. The scheme comprises the dealing with storm water, so as to prevent the flooding of certain streets by a heavy rainfall. At a luncheon which was given after the ceremony, general satisfaction was expressed by members of the Town Council with the scheme; and the Mayor stated that by next season Margate would be one of the best-drained towns in the country. The contract has been taken by Messrs. B. Cooke and Co., of Battersea, at the price of £65,888.

THE PROPOSED EXTENSION OF THE SHREWSBURY WATER-WORKS.—On Monday last week the Shrewsbury Town Council held a special meeting to consider the expediency of applying to Parliament next session for an Act to enable them (among other things) to construct new water-works in accordance with the scheme suggested by Mr. Baldwin Latham, M. Inst. C.E., as outlined in the JOURNAL for the 1st inst. (p. 654). It is still proposed to take the water from the Severn, but at a point about a mile farther up the river than that originally indicated, where the water is entirely free from town sewage. The water will be pumped to a new reservoir, filtered, and brought to the town by a new main attached to the existing ones. It was decided to apply for the Act.

PROPOSED ELECTRIC LIGHTING OF LAUNCESTON (TASMANIA).—The Launceston City Council have been advertising for tenders for the electric lighting of the city; and have received an offer from the Australian consignee of Messrs. Ganz and Co., Limited, for carrying out the work. He proposes to utilize water power to generate the current, which will be sufficient at first to supply 5600 incandescent 16-candle lamps. The whole of the plant for the installation is offered to the Council for £23,000, which is, of course, exclusive of building, tail-water channel, excavations, and masonry work. The approximate annual cost is put down at £9554; but this is reckoning only £2100 for lamp renewals, whereas double this figure would be nearer the mark. Another firm have offered to light the city by electricity as a distinct undertaking, or in conjunction with a tramway system, if the Corporation will grant the use of the streets for a sufficient term; but no figures have been submitted. The whole matter awaits a report from the Committee of the Council to whom it has been referred.

THE LONDON COUNTY COUNCIL AND THE WATER SUPPLY.—At the meeting of the London County Council last Tuesday, Mr. J. Beal, Chairman of the Special Committee on Water Supply and Markets, submitted their report which contained the following statements:—"Your Committee desire to direct the attention of the Council to the Bill they decided to introduce during the last parliamentary session in relation to water supply. This Bill provided powers for enabling the Council to institute and to carry on inquiries and negotiations with respect to the supply of water in or near the Metropolis, and to introduce Bills into Parliament relative to the subject. The Council's Bill was not proceeded with; but your Committee consider it very desirable that a similar Bill should be introduced next session, and they recommend that the Parliamentary Committee be instructed to prepare and introduce into Parliament a Bill for conferring certain powers upon the Council with respect to the water supply, similar to the Bill prepared by the Council last year." Several members of the Council stated that the recommendation would meet with their opposition; whereupon a decision on the subject was adjourned.

PROPOSED AMALGAMATION OF NELSON WITH BRIERFIELD.—A scheme is on foot for the amalgamation of the Local Board districts of Nelson, Brierfield, and Barrowford, and their incorporation as one borough. Nelson have at present rights of gas and water supply in the districts proposed to be included in the new borough; but the ground suggested for amalgamation is the necessity of combining for a common sewage scheme. The Nelson Local Board have borrowed upwards of £60,000 for gas, and a like sum for water purposes. It is estimated that the net gas profits during the present year, after allowing £3190 17s. 10d. for sinking fund and interest, will be £1946 5s. 6d., or equal to a rate of 7d. in the pound on the rateable value of Nelson, and of 5d. in the pound over the combined districts. It is also calculated that Nelson will realize a net profit from water during the present year of nearly £1000, after paying £2903 for the sinking fund and interest. If the out-districts are added to Nelson, the differential rate of gas will be abolished, which will mean a reduction of 3d. per 1000 cubic feet to outside consumers. The Nelson Local Board have decided that a petition for a Charter of Incorporation should be presented. The out-districts are to be polled on the question.

THE NORTHERN COAL TRADE.—There has been a fuller demand in the coal trade of the North; and prices, except for steam coals, are decidedly stronger. The latter are being less freely shipped; and thus the price of 9s. 6d. per ton for best Northumbrian coals, is barely maintained. Small steam coals are steady at 5s. 6d., which is comparatively higher. There is a very large demand for gas coals; and for odd cargoes 10s. per ton free on board has to be paid to obtain supplies. Some of the local contracts are now being arranged; amongst others those for the Darlington Gas-Works. The production, however, of gas coals is rather larger, so that the demand is more fully met. House coals are slow in demand; the fine weather being against a large inquiry. But for coals for manufacturing purposes, very high prices are paid; and one of the most important contracts has been closed at an advance of fully 40 per cent. on the rates paid under expiring contracts. It is quite probable that when the large quantity of coal sold for manufacturing purposes and for steamships is remembered, gas coals may be still dearer for next year's supply. Gas coke, however, is advanced; 8s. 4d. per ton being now asked at one of the inland gas-works, whilst the price at the shipping ports is 10s. Even higher prices could be had for export.

THE SHEFFIELD WATER DEPARTMENT AND OUTSIDE PLUMBERS.—At the monthly meeting of the Sheffield Town Council last Wednesday week, Mr. A. Taylor moved that it be an instruction from the Council to the Water Committee to cease soliciting for, or executing any orders for plumbing work beyond the actual requirements of the water undertaking. He said the plumbers of the town believed that more work of this kind was being done than when the concern was in the hands of the Company, and argued that for the Corporation to compete against tradesmen was unfair and unjust. He denied that other corporations did the same, and read from a large number of letters to show this was not so. The Chairman of the Water Committee (Alderman Gainsford) assured the Council that the majority of corporations did the same as Sheffield, and that the Water Department did not seek for the work. He explained that the Company originally took up plumbing because of the waste of water; and the result had been that the work was better done, not only by their men, but by private plumbers themselves. The remedy of the plumbers was to beat the department out of the market by doing the work better; but the Corporation had no right to give away to a small section of the community a part of their business, for which they had paid from £25,000 to £30,000 The motion was negatived.

PROPOSED STORAGE RESERVOIR FOR PLYMOUTH.—At the meeting of the Plymouth Town Council last Friday, the Water Committee submitted various reports from Mr. T. Hawksley, Mr. Etheridge, and the Borough Surveyor, with reference to the sites at the Head Weir and Harter respectively available for storeage reservoir purposes, and the cost of the works; supplementing the reports by the statement that the following approximate estimates of the cost of a masonry wall on each site to retain about 316 million gallons have been received from Mr. Hawksley—Head Weir wall, including excavations, £124,169; Harter wall, £86,032. The Committee were of opinion that, having regard to the fact that the probable cost of the works on either site will be far in excess of the outlay which it was contemplated would have been sufficient, and that the estimates had only been received at a recent date, it was desirable that fuller opportunity should be given for the consideration of the question of site than could be afforded in the short interval now remaining before the time arrives for issuing notices in connection with the application to Parliament in the ensuing session. They, therefore, recommended that no Bill should be prosecuted with regard to either site. Mr. J. E. Moon (Chairman of the Committee) moved the adoption of the report. Mr. Wills moved, as an amendment, that the Corporation should proceed next session to acquire a site for a storeage reservoir at Harter, and that a meeting of ratepayers should be called to give the necessary authority. After a long discussion, the amendment was carried by 22 votes to 5.

THE NEWBURY CORPORATION AND THE WATER-WORKS.—At the last meeting of the Newbury Corporation, the Committee who had been appointed to consider the question of the Corporation purchasing the works of the Newbury District Water Company reported that, at a meeting held by them on the 5th ult., they agreed in recommending that the Town Clerk should ascertain with as little delay as possible, whether the Company were prepared to open negotiations with the Council with a view to a sale by agreement of their undertaking. At a meeting on the 20th ult., a letter from the Secretary of the Company was read, in which he stated they had no desire to open such negotiations. The Committee met again on the 4th inst., when it was decided to recommend the Council to make an offer to the Company to purchase their undertaking at a price equal to £8 per £5 share; the debentures to be paid off or taken over at par. The offer to be conditional on the consent of the Local Government Board, and (if necessary) parliamentary sanction being obtained to the purchase. The Chairman of the Committee (Mr. Midwinter), in moving the adoption of the report, reminded the Board that they had twice affirmed the principle that it would be a distinct advantage to the town to have possession of the water-works. The Board first approached the Company in 1885, when their answer was much the same as now. The capital of the Company was £20,000. The fully-paid shares numbered 3150, and, with debentures, represented £17,900. He considered there should be added to the recommendation of the Committee some such words as these: "After a complete survey to the satisfaction of the Council by a duly qualified engineer." He estimated that the purchase would involve an outlay of upwards of £27,000, and expressed his conviction that the terms offered to the Company were liberal. The report was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For STOCK MARKET INTELLIGENCE, see *ante*, p. 784.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	18½-19½*	..	5 7 8
100,000	10	"	7½	Do. 7 p. c.	10	12½-13½*	−½	5 11 1
800,000	100	1 July	5	Australian (Sydney) 5% Deb.	100	109–111	..	4 10 1
100,000	20	30 May	10	Bahia, Limited	20	25–27	..	7 8 2
200,000	5	15 May	7½	Bombay, Limited	5	7½–7¾	..	4 16 8
40,000	5	"	7½	Do. New	4	5–5½	..	5 9 4
880,000	Stck.	14 Aug.	12½	Brentford Consolidated	100	228–238	..	5 5 2
125,000	"	"	9½	Do. New	100	162–167	..	5 10 6
220,000	20	12 Sept.	11	Brighton & Hove, Original	20	42–44	..	5 0 0
320,000	20	27 Sept.	11½	British	20	45–47	..	4 15 9
50,000	10	12 Sept.	11	Bromley, Ordinary 10 p. c.	10	19–21	..	5 4 9
39,000	10	"	8	Do. 7 p. c.	10	14–16	..	5 0 0
328,750	10	30 May	10	Buenos Ayres (New) Limited	10	13½–14½	..	6 18 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	106–109	..	5 10 6
150,000	20	14 Aug.	8	Cagliari, Limited	20	25–27	..	5 18 4
550,000	Stck.	16 Oct.	13½	Commercial, Old Stock	100	257-262*	−3	5 4 11
130,000	"	"	10½	Do. New do.	100	205-210*	−2½	5 2 4
130,000	"	28 June	4½	Do. 4½ p. c. Deb. do.	100	122–125	..	3 12 4
557,320	20	14 June	13	Continental Union, Limited	20	47–49	..	5 6 2
242,680	20	"	13	Do. New '69 & '72	14	33–35	+½	5 3 9
200,000	20	"	10	Do. 7 p. c. Pref.	20	37–39	..	5 2 6
75,000	Stck.	27 Sept.	10	Crystal Palace District	100	200–205	..	4 17 7
234,060	10	26 July	13	European, Limited	10	24½–25½	..	5 1 1
120,030	10	"	13	Do. New.	7½	17½–18½	..	5 5 3
354,060	10	"	13	Do. do.	5	12–12½	..	5 3 3
5,470,040	Stck.	14 Aug.	13½	Gaslight & Coke, A, Ordinary	100	246–250	..	5 10 0
100,000	"	"	4	Do. B, 4 p. c. max.	100	100–105	..	3 16 3
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	255–260	..	3 16 11
80,000	"	"	5	Do. F, 5 p. c. Prf.	100	123–128	..	3 18 1
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	182–187	..	4 0 4
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	163–167	..	4 3 10
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	253–258	..	3 17 6
1,061,150	"	14 June	4	Do. 4 p. c. Deb. Stk.	100	121–124	..	3 4 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	127–131	..	3 8 8
650,000	"	"	6	Do. 6 p. c. do.	100	171–175	..	3 8 6
3,300,000	Stck.	15 May	12†	Imperial Continental	100	215–220	+7½	5 9 1
75,000	5	14 June	6	Malta & Mediterranean, Ltd	5	5–5½	..	5 9 1
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113–115	..	4 6 11
541,920	20	14 June	6	Monte Video, Limited	20	20–21	..	5 14 3
150,000	5	30 May	10	Oriental, Limited	5	9–9½	..	5 5 8
60,000	5	27 Sept.	7	Ottoman, Limited	5	5⅞–6⅛	−⅛	5 12 9
166,870	10	26 July	4	Pará, Limited	10	4½–5½	..	7 5 8
420,000	100	2 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	103–107	..	5 12 1
500,000	100	1 June	6	2nd Do.	100	98–102	..	5 17 8
100,000	10	16 Oct.	10	San Paulo, Limited	10	16–17*	+½	5 17 8
500,000	Stck.	29 Aug.	16½	South Metropolitan, A Stock	100	305–315	..	5 3 2
1,350,000	"	"	12½	Do. B do.	100	228–233	..	5 4 1
141,500	"	"	13½	Do. C do.	100	240–250	..	5 6 0
600,000	"	28 June	5	Do. 5 p. c. Deb. Stk.	100	139–143	..	3 9 11
60,000	5	12 Sept.	11½	Tottenham & Edm'ntn, Orig.	5	11–13	..	4 8 5
				WATER COMPANIES.				
717,467	Stck.	14 June	9½	Chelsea, Ordinary	100	273–278	..	3 8 4
1,720,560	Stck.	16 Oct.	7½	East London, Ordinary	100	214-218*	+2	3 8 10
544,440	"	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	143–146	..	3 1 7
700,000	50	14 June	9	Grand Junction.	50	127–132	..	3 8 2
708,000	Stck.	29 Aug.	10½	Kent	100	276–281	..	3 14 9
1,043,800	100	28 June	9	Lambeth, 10 p. c. max.	100	259–264	..	3 8 2
406,200	100	"	7½	Do. 7½ p. c. max.	100	200–205	..	3 13 2
200,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	118–121	..	3 6 1
500,000	100	14 Aug.	12½	New River, New Shares	100	360–365	..	3 6 5
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	127–130	..	3 1 6
902,300	Stck.	28 June	6	S'thwk & V'xhall, 10 p.c. max.	100	175–180	+1	3 6 8
1,126,500	100	"	6	Do. 7½ p. c. do.	100	168–173	..	3 9 4
155,066	Stck.	14 June	10	West Middlesex	100	267–272	..	3 13 6

*Ex div.

† Next dividend, with bonus, will be at this rate.

GWYNNE & CO., ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS & ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

Exhausters of nearly all sizes in Stock.

Prize Medals at all the Great International Exhibitions.

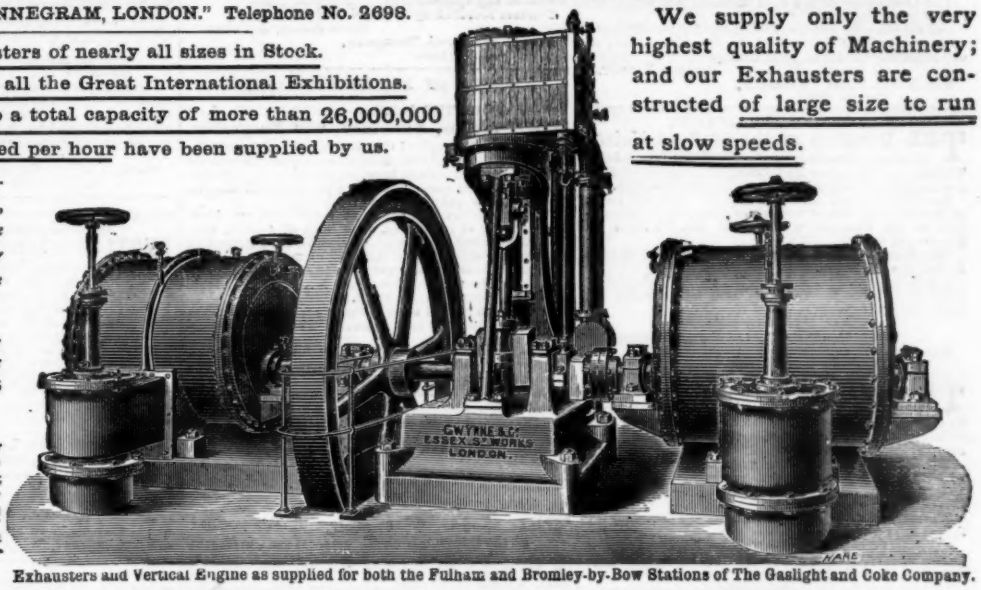
Exhausters equal to a total capacity of more than 26,000,000 cubic feet passed per hour have been supplied by us.

Our new Patent Non-Fluctuating Exhausters, to work without the slightest oscillation or variation in pressure, are strongly recommended.

MAKERS OF EVERY DESCRIPTION OF HYDRAULIC AND GAS MACHINERY.

Gwynne & Co.'s New Catalogue and List of Testimonials can now be obtained on application.

We supply only the very highest quality of Machinery; and our Exhausters are constructed of large size to run at slow speeds.



Exhausters and Vertical Engine as supplied for both the Fulham and Bromley-by-Bow Stations of The Gaslight and Coke Company.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

ANDREW STEPHENSON, Agent for the GAS PURIFICATION AND CHEMICAL COMPANY, Limited, Palmerston Buildings, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / No. 54, BERNARD STREET, LEITH, } SCOTLAND.

SULPHATE of Ammonia Lead Work and Fittings. Lead Burner. Tanks and Saturators made and repaired on the shortest notice.
Address P. J. DAVIES, 78, Earl's Court Road, Kensington, LONDON.

TAR and Liquor wanted.
BROTHERTON AND CO., Commercial Buildings, LEEDS.

SITUATION wanted as Manager or ASSISTANT. Home or Abroad. First-class practical Engineer; good Gas Chemist; well up in Carbonizing and Distribution; used to the Manufacture of Sulphate of Ammonia; has passed "Honours Examination" in City and Guilds of London Institute. Excellent Testimonials and References.
Address No. 1758, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED a Job, as Gas-fitter and SERVICE LAYER, by one accustomed to general work, &c. Good references.
Apply to T. RENDLE, 19, Portland Street, ILFRACOMBE.

BARNSTAPLE GAS COMPANY.

WANTED, a good Gas-fitter. Constant employment and good wages. One accustomed to Dipping and Lacquering preferred.
Apply to RICHARD ASHTON, Secretary and Manager.

WANTED, immediately, a good Main and SERVICE LAYER. One used to Gas-Works Plant, and with a knowledge of Smith's Work preferred. Must be a total abstainer.
Applications to state Wages expected; and testimonials as to Character, &c., to be sent to the MANAGER, Gas-Works, TROWBRIDGE.

WANTED, a complete Set of the "Re-ports of the Proceedings of The Gas Institute." Must be in good condition; price moderate.
Address CHARLES WILLIAMSON, G.P.O., MIDDLESBROUGH.

WANTED, 50 "Bower" Gas-Lamps on the Regenerative Principle. Must be new, or in condition equal to it. Single ones bought.
Address, stating net Cash Price, No. 1755, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TIMMIS & CO., of STOURBRIDGE
Make only the best quality of FIRE-CLAY RETORTS, BRICKS, TILES, & LUMPS. Also SPECIAL SILICA BRICKS, to stand great heats.
All descriptions kept in Stock.
For Prices apply to JAMES LAWRIE AND CO, 1, Whittington Avenue, Leadenhall Street, E.C., Sole Agents for London and District.
Telegraphic Address: "EIRWAL, LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 770 of last week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for Wet and Dry Gas-Meters, Station Meters, and Governors, Pressure-Gauges, Street Lamps, and Pillars, &c.
Telegraphic Address: "Braddock, Oldham."

BREEZE FURNACES FOR STEAM RAISING AND RETORT FIRING.

MELDRUM BROS. are prepared to fit up their APPARATUS *on approval* to Lancashire, Cornish, and Egg-ended Boilers.
See advertisement on title page last week.
26, Half Street, Cathedral Yard, MANCHESTER.

NOTICE OF REMOVAL.

WE have pleasure in informing Engin-eers, Secretaries, Managers, and the Trade that we have REMOVED to more commodious Offices at MANSION HOUSE CHAMBERS, 20, BUCKLERSBURY, LONDON, E.C., where all Communications will receive, as heretofore, our immediate attention.
J. & H. ROBUS,
Contractors for Gas and Water Works, Mansion House Chambers, 20, Bucklersbury, E.C.

FOR SALE—One Single Gasholder, 80 feet by 20 feet (owing to extensions at Blackpool). To be erected complete; in first-rate condition.
Apply to CLAYTON, SON, AND CO., LIMITED, Hunslet, LEEDS.

FOR SALE—Single Gasholder, 42 feet diameter by 14 ft. 16 in. deep. Capacity, 18,000 cubic feet.
Apply to the BISHOP'S STORTFORD GAS COMPANY, LIMITED, BISHOP'S STORTFORD.

FOR SALE—Messrs. R. and J. Dempster have FOR SALE, owing to the making of some extensive Alterations at the Coventry Gas-Works—
Seven PURIFIERS, 20 feet square, complete with Lids, Grids, Tee-Bars, Lifting Apparatus, &c., &c. The Purifiers are of modern construction, strong and durable, having the Lutes cast on the side Plates; and all Joints are planed. The Purifiers will be sold cheap, either singly or as required to suit purchasers; and they can be delivered free on Rails, or Messrs. R. and J. Dempster will be glad to give a price delivered and fixed complete at any Gas-Works.
Also two 18-inch FOUR-WAY VALVES and Connections.
Also two LIVESEY WASHERS, capable of passing 2 million cubic feet of Gas per day each.
For further particulars, apply to Messrs. R. & J. DEMPSTER, Newton Heath, MANCHESTER.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID for making SULPHATE OF AMMONIA of high quality and colour. *Delivery in Railway Tank-Wagons or Carboys*
Highest References and all particulars supplied on application.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

ESTABLISHED 1869.

HYDRATED Oxide of Iron (Bog Ore). Purity and Uniformity of Quality guaranteed. Stocks kept at MINES for direct Shipments to any Port, also at Garston Docks.
GEO. G. BLACKWELL, Mine Proprietor, 25, 26, and 27, Irwell Chambers, W. LIVERPOOL.

BY ORDER OF THE DIRECTORS.

£19,167 Perpetual Four Per Cent. Debenture Stock of the West Ham Gas Company, authorized to be raised in pursuance of the "West Ham Gas Act, 1889," and offering to Trustees and others Investments of the soundest character.

MR. ALFRED RICHARDS is favoured with instructions from the Directors of the West Ham Gas Company to submit the above for Sale by Auction at the Mart, Tokenhouse Yard, E.C., on Thursday, Nov. 7, 1889, at One for Two o'clock precisely, in Lots of £100 Stock.
Particulars may be obtained of the SECRETARY to the Company, at the Offices, Union Street, STRATFORD, and of the AUCTIONEER, 8, NEW BROAD STREET, E.C.

TOWN HALL, HALSTEAD.
IMPORTANT SALE OF GAS SHARES.

MESSRS. BENTALL and SON have received instructions from the Executors of a gentleman recently deceased to offer for Sale by Public Auction

AT THE TOWN HALL, HALSTEAD,
On Tuesday, October 29, 1889,
at Two for Three o'clock in the Afternoon, in various Lots to suit the convenience of purchasers,
315 "A" SHARES of £10 each
in the
HALSTEAD GAS COMPANY, LIMITED.

The Shares have remained in the possession of the late Proprietor since the incorporation of the Company, upwards of eight years ago; and are only now offered for Sale in order to facilitate the distribution of his Estate amongst the beneficiaries under his will resident abroad.

The Company is in a flourishing condition, and has a strong body of Directors, principally consisting of gentlemen in the neighbourhood.

A Dividend at the rate of 5½ per cent. per annum has been regularly and continuously paid in respect of the "A" Shares since the formation of the Company, with the exception of the half-years ending December, 1882, and December, 1884, which was owing to exceptional circumstances.

Further particulars may be obtained of the Auctioneers at their offices, High Street, Halstead, or of Messrs. Harris, Morton, and Harris, Solicitors, Halstead, at whose offices the half-yearly reports can be examined—a member of the firm being Secretary of the Company

COLNE AND MARSDEN LOCAL BOARD.

THE Gas Committee of the above-named Board are prepared to receive TENDERS for Wet and Dry GAS-METERS which may be required by them for the ensuing Twelve months.

Full particulars and forms of tenders may be obtained on application to the undersigned.

The Committee do not bind themselves to accept the lowest or any tender.

Sealed tenders, endorsed "Tender for Gas Meters," to be sent to the Chairman of the Gas Committee, on or before the 4th day of November next.

THOMAS VARLEY.

Gas-Works, Colne, Lancashire,
Oct. 16, 1889.

TO GASHOLDER MAKERS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for adding THIRD LIFTS to two TELESCOPIC GASHOLDERS (each 150 feet diameter) at their Neepsend Station.

Specification and drawings may be seen, and forms of tender with bill of quantities obtained, on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders, marked "Tender for Enlarging Gasholders," addressed to the undersigned, must be delivered not later than Saturday, the 2nd of November.

By order,
HANBURY THOMAS, General Manager.

Gas Company's Offices, Commercial Street,
Sheffield, Oct. 18, 1889.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the Supply and Erection of an IRON ROOF (100 feet by 50 feet), to form a Coke-Shed at their Effingham Street Station.

Specification and drawings may be seen, and forms of tender with bill of quantities obtained, on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders, marked "Tender for Iron Roof," addressed to the undersigned, must be delivered not later than Saturday, the 2nd of November.

By order,
HANBURY THOMAS, General Manager.

Gas Company's Offices, Commercial Street,
Sheffield, Oct. 18, 1889.

LANCASTER CORPORATION.

TENDERS FOR GASHOLDER EXTENSION.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the necessary ALTERATION and ADDITION for converting a 130-feet diameter SINGLE-LIFT GASHOLDER into a Three-Lift, at the Corporation's Gas-Works, St. George's Quay, Lancaster.

Plans may be seen, and copies of specification may be had, on application to the undersigned, on payment of two guineas, which will be returned on receipt of a *bond fide* tender.

Sealed tenders, endorsed "Tender for Gasholder Extension," to be sent to Thom. Swainson, Esq., Town Clerk, Lancaster, on or before the 16th prox.

The Committee do not bind themselves to accept the lowest or any tender.

CHARLES ARMITAGE.

Gas-Works, Lancaster, Oct. 15, 1889.

THRAPSTON GAS AND COKE COMPANY, LIMITED.

THE Directors are prepared to receive TENDERS for the Supply and Laying of about 200 yards of 2-inch GAS MAINS.

Particulars may be obtained of the Secretary.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders received up to the 26th of October.

THOS. EATON, Secretary.

New Market Road, Thrapston,
Oct. 16, 1889.

BOROUGH OF BURTON-UPON-TRENT.

NEW PURIFIER HOUSE—CONTRACT No. 6.

THE Mayor, Aldermen, and Burgesses, of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS from competent persons for the Construction and Erection of a New PURIFIER HOUSE, and the execution of Works incidental thereto, at their Gas-Works in the said Borough.

Full particulars and copies of conditions, specification and bill of quantities, with form of tender, may be obtained, and the drawings viewed, on payment of five pounds (which will be returned on receipt of a *bond fide* tender, with bill of quantities fully priced out) on application to the Gas Engineer, Mr. F. L. Ramsden, Gas-Works, Burton-upon-Trent.

Persons desirous of contracting are requested to make early application, as only a limited number of copies will be issued.

Sealed tenders, endorsed "Tender for New Purifier-House," are to be delivered to me at or before Ten a.m. on Saturday, the 2nd of November next.

The Council do not bind themselves to accept the lowest or any tender, nor will they pay any expense or charge relating to the making or delivery of the same.

T. N. WHITEHEAD, Town Clerk.

Burton-upon-Trent, Oct. 19, 1889.

BOROUGH OF BURTON-UPON-TRENT.

NEW PURIFIERS, &c.—CONTRACT No. 7.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS from competent persons for the Supply, Construction, Erection, and Fixing of Four PURIFIERS and TRAVELLING LIFTING GEAR for same, and for the COLUMNS, GIRDERS, JOISTS, and STANCHIONS, forming Superstructure, together with a CENTRE-VALVE and CONNECTIONS; also a Wrought-Iron ROOF, &c., for a new PURIFIER HOUSE at the Gas-Works, in the said Borough, and the Execution of Works incidental thereto, respectively.

Full particulars and copies of conditions, specification, and bill of quantities, with form of tender, may be obtained, and the drawings viewed, on payment of five pounds (which will be returned on receipt of a *bond fide* tender with bill of quantities fully priced out) on application to the Gas Engineer, Mr. F. L. Ramsden, Gas-Works, Burton-on-Trent.

Persons desirous of contracting are requested to make early application, as only a limited number of copies will be issued.

Sealed tenders, endorsed "Tender for New Purifiers, &c.," are to be delivered to me at or before Ten a.m., on Saturday, the 2nd of November next.

The Council do not bind themselves to accept the lowest or any tender, nor will they pay any expense or charge relating to the making or delivery of the same.

T. N. WHITEHEAD, Town Clerk.

Burton-upon-Trent, Oct. 19, 1889.

BRISTOL UNITED GASLIGHT COMPANY.

TENDERS FOR TAR.

THE Directors of this Company invite TENDERS for the purchase of the TAR to be produced at all or either of their three Stations, during a period of One, Two, or Three years, commencing on the 1st day of January, 1890.

The annual quantities of Tar produced at each of the Stations at present are approximately as follows:—

Avon Street	525,000 gallons.
Canons' Marsh	470,000 "
Stapleton	450,000 "

Further particulars, with forms of tender, may be obtained on application to the undersigned, to whom also tenders sealed, and endorsed "Tender for Tar," must be delivered not later than Ten a.m., on Monday, the 4th day of November prox.

JAMES V. GREEN, Secretary.

Gaslight Offices, Canons' Marsh,
Sept. 20, 1889.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
INCORPORATED BY ACT OF PARLIAMENT.

NOTICE is hereby given, that the Half- yearly ORDINARY GENERAL MEETING of the Proprietors of this Association will be held at the City Terminus Hotel, Cannon Street, London, E.C., on Tuesday, the 12th day of November next, at 2.30 p.m. precisely, when a Report will be made to the Proprietors, a Dividend declared for the Half Year ended the 30th of June last, and the usual ordinary Business of such Meeting transacted.

Notice is hereby also given, that the Transfer Books will be closed from the 29th inst. to the 12th of November, both days inclusive.

By Order of the Board,
R. S. GARDINER, Secretary.

30, Clement's Lane, Lombard Street,
London, E.C., Oct. 21, 1889.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

NOTICE is hereby given that the Ordi- NARY HALF-YEARLY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, 30, Gracechurch Street, in the City of London, on Tuesday, the 5th day of November next, at Three o'clock in the Afternoon precisely, to receive the Directors' Report and the Accounts of the Company, for the Half Year ended the 30th day of June last, to declare a Dividend, to elect an Auditor, and to transact the General Business of the Company.

The Transfer Books will be closed from the 23rd of October to the 5th of November next, both inclusive.

By order of the Board,
ALFRED LASS, Secretary.

Offices: 30, Gracechurch Street,
London, Oct. 8, 1889.

CONSPIRACY and Protection of Pro- perty Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

Now Ready, price 15s., limp cloth, the Ninth Yearly

ANALYSIS OF THE ACCOUNTS

OF THE

METROPOLITAN WATER COMPANIES,

CHELSEA, EAST LONDON, GRAND JUNCTION, KENT,
LAMBETH, NEW RIVER, SOUTHWARK & VAUXHALL, AND WEST MIDDLESEX.

SHOWING THE

CAPITAL, INCOME, EXPENDITURE, PROFITS, and DIVIDENDS, per MILLION and per THOUSAND GALLONS of WATER SUPPLIED; the PROPORTION of EXPENDITURE and PROFITS to GROSS INCOME; and the INCOME, EXPENDITURE, and PROFITS per HOUSE, &c., supplied.

FOR THE YEAR ENDED { DEC. 31, 1888. / MARCH 31, 1889.

TOGETHER WITH

THE QUANTITY OF WATER SUPPLIED,
THE ESTIMATED DAILY QUANTITY SUPPLIED FOR DOMESTIC AND OTHER PURPOSES,
THE QUANTITY SUPPLIED PER HEAD OF POPULATION, &c., &c.,

FOR THE YEAR ENDED DECEMBER 31, 1888.

Compiled and arranged by ALFRED LASS, Fellow of the Institute of Chartered Accountants.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

Now Ready, Fcap. 4to, Cloth, Gilt Lettered, with numerous Illustrations, price 7s. 6d., post free.

Practical Photometry:

A GUIDE TO THE STUDY OF THE

MEASUREMENT OF LIGHT.

By William Joseph Dibdin, F.I.C., F.C.S.,

Member of the Society of Public Analysts and of the Committee of the London Section of the Society of Chemical Industry.

Chemist and Superintending Gas Examiner to the London County Council.

The aim of the Author has been to give a comprehensive account of the various methods of Photometry in daily use, and to make the book thoroughly practical by indicating the many precautions necessary for ensuring accurate results in photometrical work. The volume contains chapters on the History and Principles of Photometry; Horizontal, Radial, and Jet Photometers; Standards of Light; the Proposed Substitute for Candles; the Auxiliary Apparatus required in Testing Gas; the Examination and Adjustment of a Gas-Testing Photometer; and Colour and Stellar Photometry; together with an Appendix comprising the Notification of the Metropolitan Gas Referees, Tables for the Correction of Volume of Gas and Observations of Candles, and other matter useful to Photometrists.

London: WALTER KING, 11, Bolt Court, FLEET ST., E.C.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Inventions may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

GEO. E. TOURNAY,

Retort-Setter,

Contractor for the Erection of Retort-Ovens, Chimney Shafts, &c.,

THANNINGTON, CANTERBURY.

GEORGE McKAIG,

MANUFACTURER OF **WOOD GRIDS** FOR GAS PURIFIERS,

36, Cleveland Street, DONCASTER.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

Prices are Reduced.

JAMES NEWTON & SONS,

(Established 1820)

FIRE-BRICK AND TILE MERCHANTS,

Wholesale and for Exportation,

FALCON DOCK, 78 AND 79, BANKSIDE,

SOUTHWARK, LONDON, S.E.

DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES and FIRE-CLAY and every Article suitable for

GAS AND WATER WORKS.

COZE'S

AUTOMATIC SYSTEM

OF

Charging and Drawing Retorts.

THIS System of automatically Charging and Discharging Retorts without machinery or arduous labour, which is in operation at several places, will shortly be at work in England.

All information as to the advantages, cost, &c., of the System, can be obtained from the undersigned, who will arrange to grant the user for a small Payment per Retort, or a slight Royalty. The System is fully patented; and any infringer will be strictly proceeded against.

An Agent will shortly be appointed in England.

A. COZE,

MANAGER, RHEIMS GAS COMPANY, FRANCE.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY,

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co.,

ALBERT WORKS, WIDNES.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

MIRFIELD, NORMANTON.

THOMAS ILLINGWORTH,

NORTH DEAN CHEMICAL WORKS,

Near HALIFAX,

MANUFACTURER OF SULPHURIC ACID

OF EXTRA QUALITY FOR MAKING

WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE

Purchased for Cash against Delivery.

IMPROVED RETORT SETTING.

W. G. WALLER & Co.,

RETORT SETTERS & CONTRACTORS,

Having had much experience in the Setting of Retorts beg to call the attention of Gas Engineers and Managers to their Improved System of Setting Retorts and Tar-Furnaces.

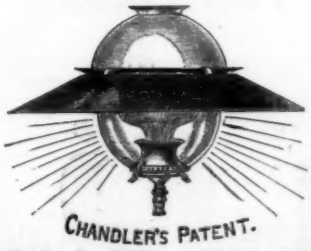
Contractors for Building Shafts, Tanks, Retort Benches, and all other Buildings connected with Gas-Works.

Estimates on application.

The Poplars, Waddon, Croydon, Surrey.

THE

"SILVER" LIGHT.



CHANDLER'S PATENT.

SUITABLE FOR EVERY FORM OF LIGHTING.

A beautiful white light from ordinary Gas. Silent, steady, and economical.

PACKED IN BOX 9s., SUBJECT.

S. CHANDLER & SONS,

Central Works, Kennington Oval, S.E.

CAST-IRON PIPES

FOR GAS AND WATER.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

Newland Gas Coal

For particulars, apply to

LOCKE & CO.,

NORMANTON,

YORKSHIRE.

GAS AND WATER PIPES.

1¼ to 12 IN. BORE.

THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

GLASGOW OFFICE: 24, GEORGE SQUARE.

Telegrams:

"BONLEA, STOCKTON-ON-TEES."

"SPRINGBANK, GLASGOW."

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·36 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft
Illuminating Power	16·3 candles
Coke	70 per cent.

For Prices and complete Analysis, apply to

YOUNG, DANCE, & CO.

COAL OWNERS, NEWCASTLE-ON-TYNE,

Or E. FOSTER & CO., 21, John St., Adelphi, LONDON, W.C.

THE ONLY RELIABLE

DRY CENTRE-VALVE.

WORKING ONE, TWO, THREE, OR FOUR PURIFIERS ON AT THE TIME.

ALSO MADE FOR TWO OR THREE PURIFIERS.

No Springing. No Leakage. No Foul Gas passed in Changing. Special Facility for Blowing the Air out of the Fresh Box before putting in Action, without driving it forward into the Holders.

Write for Prospectus.

ALSO DOUBLE-ACTION DOUBLE-FACED GAS & WATER VALVES.

F. WECK, 86, NEW STREET, BIRMINGHAM.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

MARQUIS OF LOTHIAN'S

NEWBATTLE CANNEL.

QUOTATIONS ON APPLICATION TO

MR. JOHN MORISON,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

THOMAS TURTON AND SONS, LIMITED,

Sheaf & Spring Works,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

ROBERT MARSHALL,

CANNEL COAL MERCHANT

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

GAS COAL.

POPE & PEARSON, LTD.,

have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles; or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17¼ candles.

One ton yields 12¼ cwt. of good coke.

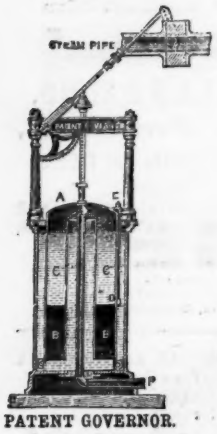
This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

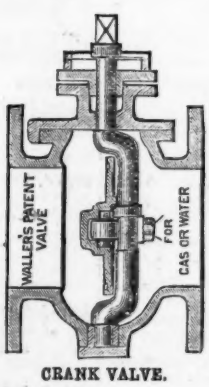
GEORGE WALLER & Co.'s NEW PATENT EXHAUSTER.

MADE WITH 4, 3, OR 2 BLADES.

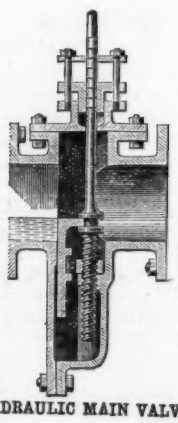
Also BEALE'S EXHAUSTERS.



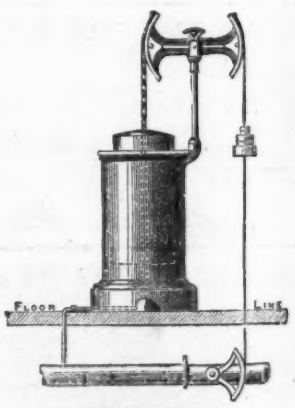
PATENT GOVERNOR.



CRANK VALVE.

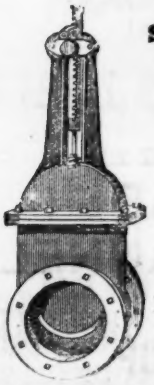


HYDRAULIC MAIN VALVE.

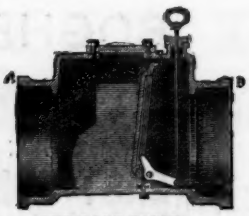


GAS GOVERNOR.

SCRUBBERS, PURIFIERS, CONDENSERS, COKE-BREAKERS.



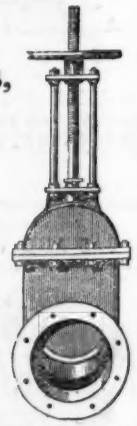
OUTSIDE RACK VALVE.



BYE-PASS VALVE.

INDEX VALVE.

DISC VALVE.



OUTSIDE SCREW VALVE

SEE PREVIOUS ADVERTISEMENTS. ILLUSTRATED CATALOGUE ON APPLICATION.

Phœnix Engineering Works, Park Street, Southwark, London, S.E.,

NEAR SOUTHWARK BRIDGE (FOUR MINUTES FROM HOLLAND STREET), AND AT

STROUD, GLOUCESTERSHIRE.

GAS COAL.

BEST
REAL OLD SILKSTONE GAS COAL.
Address, THE STRAFFORD COLLIERIES COMPANY,
Near BARNSLEY, SOUTH YORKSHIRE.

LAMBERT BROS. ALPHA TUBE AND FITTING WORKS, WALSALL

MANUFACTURERS OF WROUGHT-IRON TUBES AND FITTINGS, BRASS GAS-FITTINGS, GAS-VALVES, STEAM AND WATER VALVES, &c.,
And of WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: T. LAMBERT & SONS, SHORT STREET, LAMBETH, S.E.

SPENT LIMES NO LONGER WASTE PRODUCTS!

G. R. HISLOP'S PATENT REGENERATIVE PROCESS

MOST EFFECTIVELY AND *ECONOMICALLY RESTORES* LIME WASTES CONTINUOUSLY.

The Patentee having under his several Patents effected a complete solution of the Spent Lime difficulty, most confidently solicits the consideration of the fact by the Engineers and Managers of Gas Companies, Gas Corporations, and other Spent Lime producers. The adoption of these Patents secures the following amongst other advantages, viz.:—1st. Nuisance is avoided, and the utmost convenience and comfort in Gas purification are secured. 2nd. The Lime is recovered at from one-third to one-half the cost of new Lime, or from 5s. 6d. to 7s. 6d. per Ton (depending on extent of works and working charges). 3rd. The Lime is either recovered for Building and Agricultural purposes, or specially and continuously for Gas purification—no limit being assigned to its durability. 4th. Nearly the whole of the valuable sulphur is collected and sold. 5th. By the Patentee's Improved Furnace, breeze or inferior cannel coke only is required as a fuel. The process has been worked for a considerable time by several important Gas Companies and Corporations throughout the Kingdom, and with the most satisfactory results. The Patentee erects, proves, and grants working on very moderate terms.

Further particulars may be had on application to A. F. Wilson, Esq., Assoc. M. Inst. C.E., 12, Walbrook, London, E.C., Agent for London; J. E. Fisher, Esq., Stourbridge, Agent for the rest of England, Wales, and Ireland; or to the Patentee—

GEO. R. HISLOP, Engineer, GAS-WORKS, PAISLEY, N.B.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,
PATENTEE OF
A SPECIAL COMPOUND
FOR THE CURE OF STOPPED ASCENSION-PIPES,

A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power

PRICE AND PARTICULARS ON APPLICATION.

Head Office: CORPORATION STREET, BIRMINGHAM.

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF
IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES
FOR ANY PURPOSE.

SPECIALITIES.

THE "NUGENT"
RECUPERATIVE RETORT SETTINGS and FURNACES.

"ROBUS" IMPROVED
RETORT SETTINGS, with COKE, TAR, and BREEZE FURNACES.

THE ABOVE SETTINGS & FURNACES ARE PROVING EMINENTLY SATISFACTORY.

Every Particular, with Estimates, forwarded upon Application to

MESSRS. J. & H. ROBUS,
CONTRACTORS FOR THE ERECTION OF GAS & WATER WORKS,
20, BUCKLERSBURY, LONDON, E.C.

FACE YOUR RETORT MOUTHPIECES.

JOHN RUSCOE calls attention to his Retort Mouthpiece and Lid Facing Machines, which are in extensive use; also to his Lathes, Drilling, Slotting, Grooving, and Planing Machines, Smiths' Hearths, Smithy Fans, Roots' Blowers; also special Screwing Machines for Gas Tubes and Bolts, Taps, Wrenches, Pipe Cutters, special Taper and Twisted Rymers, Drills, &c.

PATENT TWISTED TAPS, DIES, & CUTTERS.

Thousands in constant work, give universal satisfaction.

Work Easier, Less Friction, Last Longer, and do Better Work than straight Grooves.

Main Drilling Stand, with Cup Drills, 1½ to 6 inch; Taps, Rymers, and Drills.

Ratchet Screwing Stocks, and Adjustable Once-up Stocks, Dies, Guides, &c.

Inquiries and Trial Orders Solicited. Everything Guaranteed. Apply to

JOHN RUSCOE, Albion Works, Hyde, near Manchester.

BRECKENRIDGE CANNEL,

OF KENTUCKY, U.S.A.

The undersigned, SOLE AGENTS for this celebrated Gas Cannel, now offer it for delivery at any port in

GREAT BRITAIN,

ON THE CONTINENT,

OR SOUTH AMERICA.

This Cannel ranks with the Australian Shale as an enricher of Coal Gas; One Gross Ton producing

15,000 Cubic Feet of 50-Candle Gas, & 26 Bushels of superior Marketable Coke.

FOR PRICES AND FURTHER PARTICULARS, APPLY TO

PERKINS & Co., SOLE AGENTS,

Cable Address: "Perkins New York." 228, PRODUCE EXCHANGE, NEW YORK.

SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

The Schülke Regenerative Lamp

FOR

DOMESTIC AND EXTERNAL LIGHTING.

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

A PURE WHITE & PERFECTLY STEADY LIGHT,

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

SCHÜLKE GAS-LAMP Co.

LIMITED,

Room 446—11, QUEEN VICTORIA STREET,

LONDON, E.C.,

Where Price Lists and full particulars may be obtained.

JOSEPH CLIFF AND SONS,

THE ORIGINAL (ESTABLISHED 1795). **WORTLEY FIRE-BRICK WORKS,**

NEAR LEEDS.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

AT THE PARIS EXHIBITION, 1878,

THREE MEDALS AND HONOURABLE MENTION

WERE AWARDED TO

JOSEPH CLIFF & SONS,

For their Various Exhibits, amongst which is a

SILVER MEDAL FOR THEIR PATENT MACHINE-MADE RETORTS AND FIRE-BRICKS,

Being the Highest Honour given for this Class.

London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

WATER GAS FUEL GAS

FOR INDUSTRIAL PURPOSES

GENERATED FROM

BITUMINOUS SLACK COAL

BY THE

LOOMIS PROCESS.

The Cheapest Gas-Generating System in the World.

NOVEL IN DESIGN.
MODERN IN CONSTRUCTION.
SIMPLE IN OPERATION.
PERFECT IN RESULTS.

PROCESS AND APPARATUS PATENTED IN ALL COUNTRIES.

By this system more gas, and of a higher heating power per cubic foot, can be generated from a ton of Bituminous Slack Coal than by any other from a ton of Anthracite Coal or Coke.

The successful application of Water Gas for industrial purposes was brought about through this Process at the Works of the—

JOHN RUSSELL CUTLERY COMPANY, Turner's Falls, Mass., where it has been in daily use upwards of two years, doing all the Forging, Hardening, and Tempering.
HENRY DISSTON & SONS, Steel, Saw, and File Works, Philadelphia.
AMERICAN WALTHAM WATCH COMPANY, Waltham, Mass.
ADDYSTON PIPE AND STEEL COMPANY, Cincinnati.

Many other industrial establishments in America are successfully using this Process, and a large number of Works are now being erected including a plant at Brussels and at Sheffield (at Messrs. Thomas Firth and Sons, Limited).

This process is especially adapted for firing all classes of Pottery, Tile, and Brick Kilns.

For particulars apply to

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD.

THE GAS APPARATUS Co., PETERBOROUGH,

GAS ENGINEERS,

Manufacturers, Gas-Works Furnishers,

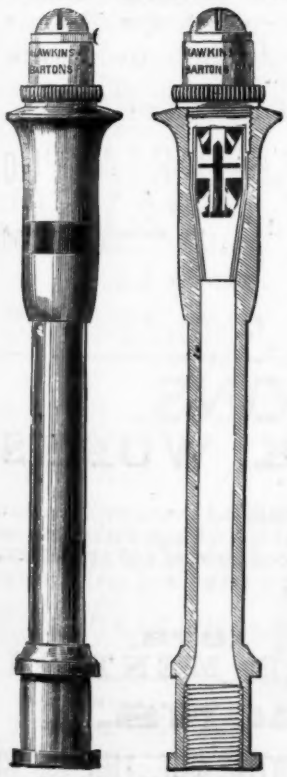
AND MAKERS OF ALL KINDS OF

Gas Burners, Governors, Lamps, Gauges,

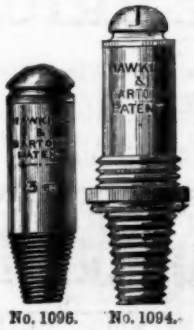
AND SPECIALTIES OF EVERY DESCRIPTION.

ALSO SOLE MANUFACTURERS OF

Hawkins & Barton's Patent Self-Regulating Lamp Governors and Burners.



Full Size, No. 1098.
These Governors are made to take to pieces for cleaning and re-adjusting.



No. 1096. No. 1094.

An enormous quantity of these Burners are in use in this Country and abroad; and they have never failed to give satisfaction. Wherever they are adopted, complaints against Bad Gas and Excessive Gas Bills naturally cease. Owing to their extreme simplicity, they cost less than half that of any others, and will last years without attention.

Trial Orders Solicited.

PRICES AND TERMS ON APPLICATION.

Works & Offices: PETERBOROUGH.

REPORTS

By T. NEWBIGGING, Esq., C.E
Feb. 25, 1889.

Burner tested, 4 feet.
Pressure, 10, 15, 20, 25 tenths.
Consumption, 4, 4, 3·95, 3·8 feet.

By G. BOWER, Esq., C.E.,
St. Neots, *March* 12, 1889.

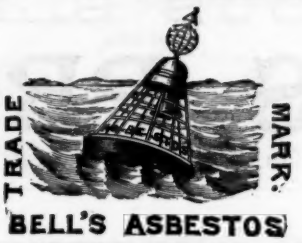
"I have tested your Pressure Regulating Burners; and I find that those you sent me do not vary more than two-tenths under pressures varying from six to forty tenths. I shall not only use them myself, but I shall recommend others to use them."

By J. MACKAY, Esq., Engineer,
Gas-Works, Peterhead,
July 13, 1889.

"The enclosed Burner has been in use here all last winter, and does not seem much the worse. We had seven different kinds of Governors on trial, and yours seemed to come out the best. Please send gross more of the same kind."

Awarded FIRST PRIZE MEDAL at the Falmouth Royal Polytechnic Exhibition, 1889.

BELL'S ASBESTOS AQUOL PAINT



IS MADE READY FOR USE.

IS FIRE RESISTING.
IS WASHABLE.
IS NON-POISONOUS.
IS MANUFACTURED IN ALL USEFUL COLOURS.
IS IMPERVIOUS TO HEAT, COLD, OR WATER.
IS WITHOUT SMELL.

No expensive Oil or Turpentine required.

WILL NEVER BLISTER.

HAS A COVERING CAPACITY 40 PER CENT. GREATER THAN LEAD PAINTS.

For Outside or Inside Work in any Climate.

Bell's Asbestos Aquol Paint is equally suitable for the finest decorative work as well as for general painting. It can be applied over or under any other paint, and, owing to its easy application, can be used with a large distemper brush; the SAVING THUS EFFECTED IN LABOUR BEING **50** PER CENT. OVER THAT OF LEAD PAINTS.

Bell's Asbestos Aquol Paint is susceptible of the most delicate treatment; and, owing to its perfect flatted surface, it brings up the varnish in a manner that no other paint can equal. ONE COAT OF VARNISH ON **Bell's Asbestos Aquol** IS EQUAL TO TWO COATS ON ORDINARY PAINT.

BELL'S ASBESTOS AQUOL PAINT is specially adapted for Private Houses, Exhibition Buildings, Ships, Churches, Asylums, School Boards, Railway Stations, and all work of Wood, Iron, Cement, Plaster, Stone, Brick, &c., &c.

Those who Study Economy and Protection from Fire should use only

BELL'S ASBESTOS AQUOL PAINT.

BELL'S ASBESTOS AQUOL PRIMING is made Ready for Use.
BELL'S ASBESTOS AQUOL PRIMING stops all suction of Wood, Cement, Plaster, &c.
BELL'S ASBESTOS AQUOL PRIMING should be applied to all New Work.

Suitable for Ceilings, Walls, and New Wood, and is very durable.

BELL'S ASBESTOS AQUOL KNOTTING, for Stopping Knots in New Work.

AN EXCELLENT CURE FOR DAMP WALLS.

Colour Cards and Price Lists on Application.

Supplied in Casks of 5 to 7 cwt., and Iron Drums of 28, 56, and 112 lbs., Sample Tins of 7 and 14 lbs.

Owing to its Covering Capacity, a SAVING IN FREIGHT of 40 per cent. is effected for a given surface.

BELL'S ASBESTOS COMPANY, LIMITED,

SOUTHWARK, LONDON, S.E.

DEPOTS—MANCHESTER: Cable Street, Blackfriars. LIVERPOOL: 2, Strand Street, James Street. CARDIFF: West Bute Street. BIRMINGHAM: 7, John Bright Street. HULL: Humber Dock Basin. GLASGOW: 35, Robertson Street. DUBLIN: 2, St. Andrew Street. BERLIN and BARCELONA.

BELL'S ASBESTOS

EXPANSION SHEETING.

The above, which can only be obtained from this house, is recognized as the **most efficient and economical jointing material in use.** It is composed of a specially-prepared India-rubber Compound, protected by a covering of Vulcanized Asbestos Sheeting, as shown above; and as it is the only Jointing Material which adequately **combines permanent elasticity with heat resistance,** the advantage it possesses will at once be seen.

EXPANSION RINGS.

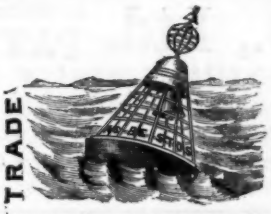
The centre from which the requisite elasticity is obtained will adapt itself to uneven surfaces to which it may be applied, and allow the expansion and contraction to be fully taken up. The covering being of Asbestos Cloth imparts a protection to the centre, and so prolongs its elasticity. **For Manhole, Mudhole, Steam Pipe, and Mash Tun Door Joints, it is unequalled;** and if applied as directed, **a ring can be used many times over.**

Made from 1-Ply for Cylinder and Faced Joints to any thickness for Uneven Surfaces.

BELL'S ASBESTOS CO., Ld.

DEPÔTS.

MANCHESTER: Cable St., Blackfriars.
LIVERPOOL: 2, Strand St., James St.
HULL: Humber Dock Basin.
DUBLIN, BERLIN.



BELL'S ASBESTOS.

DEPÔTS.

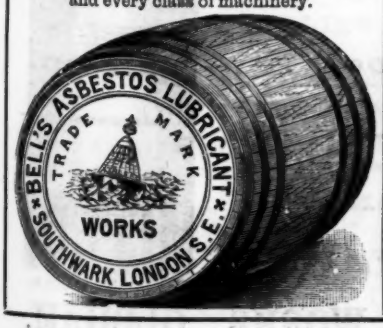
BIRMINGHAM: 7, John Bright Street.
GLASGOW: 35, Robertson Street.
CARDIFF: West Bute Street.
And BARCELONA.

Southwark, London, S.E

BELLS ASBESTOS
YARN AND SOAPSTONE PACKING
Is the BEST LOCOMOTIVE PACKING made.

BELL'S
COMPOUND HYDRAULIC PACKING
Is specially suited for Hydraulic Machinery, Accumulators, and Ammonia and all Pumps.

BELL'S ASBESTOS LUBRICANT
Is unequalled
For Steam-Engines & Cylinders, Gas-Engines, and every class of machinery.



BELL'S ASBESTOLINE
The reputation of this Lubricant is based on the experience of thousands of users, which places it far in advance of those who rely only on mere laboratory tests.

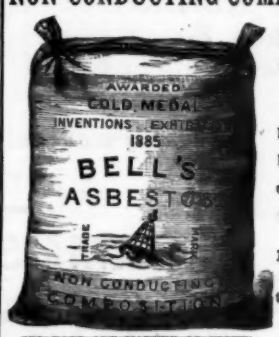
ASBESTOLINE IS THE CHEAPEST MOST EFFICIENT, CLEANEST MOST INODOROUS AND SAFEST LUBRICANT.

ASBESTOLINE HAS SAVED 90 PER CENT. OVER OIL.

Has been used for all purposes, AND BEATEN ALL OTHER LUBRICANTS IN ACTUAL WORK.

BELL'S ASBESTOS
"DAGGER" PACKING
Is unequalled for every kind of Marine and Land Engine, Steam-Pumps, &c., and has proved itself to be the most efficient, durable, and economical Packing made.

BELL'S ASBESTOS
NON-CONDUCTING COMPOSITION.



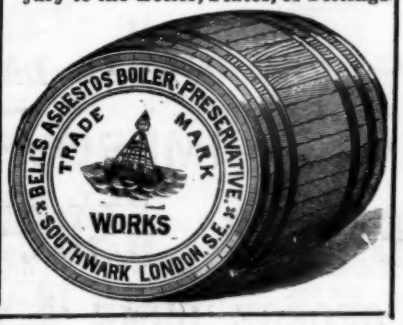
ALL BAGS ARE MARKED AS ABOVE.

Will reduce loss by radiation, and saves 40 per cent. of fuel.

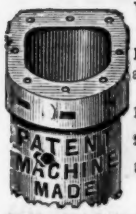
Is suitable for boilers with flat or round bottoms. Is superior to any other, and saves its cost in a few months.

Is sent out dry in bags; therefore cheaper than others sent out wet.

BELL'S ASBESTOS
BOILER PRESERVATIVE
Will effectually keep Boilers clean, and remove any Incrustation, without injury to the Boiler, Plates, or Fittings.



WILLIAM INGHAM & SONS,



WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing Adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

JOHN HALL & CO.,
STOURBRIDGE
MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
RETORTS CAREFULLY PACKED FOR SHIPMENT.
A STOCK OF DIFFERENT SHAPES ON HAND.

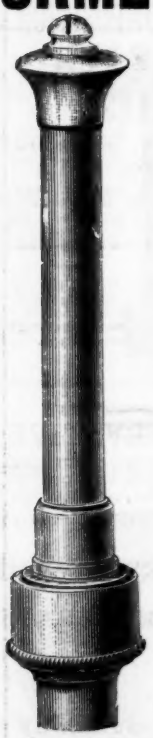
CASES FOR BINDING
VOLUMES OF THE "JOURNAL,"
(GREEN CLOTH, GILT LETTERED)
MAY BE HAD OF THE PUBLISHER,
PRICE 2s. EACH.

THE THAMES BANK IRON CO.
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S 'PATENT' GAS MAIN SYPHONS.
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

D. HULETT & CO., Ltd.
Invite attention to the following Specialities:—
PATENT STREET LAMPS,
NO PUTTY OR OTHER MATERIALS ARE REQUIRED TO SECURE THE GLASS. PRICE 9s. 9d. EACH NET.
D. Hulett's Improved Service Cleanser, for the removal of Naphthalene and other obstructions in Service-Pipes, Price 70s. net.
IMPROVED HIGH-POWER LANTERNS; PRICES ON APPLICATION.
Patentees of Improved Wet and Dry Gas-Meters.
Makers of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.

SHOW-ROOM AND WORKS: **55 & 56, HIGH HOLBORN, LONDON.**

ORME'S GAS REGULATOR FOR STREET LAMPS
(Behl's Patent)



No. 200.
LAMP REGULATOR
Full Size.

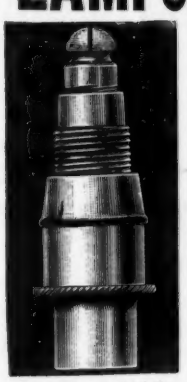
Adopted by the leading GAS COMPANIES AND CORPORATIONS.
More than 150,000 now in use.
Strongly made, all Brass, as Illustration No. 200,
Price, 24/- per dozen.

ORME'S GAS REGULATOR
(BEHL'S PATENT),
No. 201, 202, 203, FOR DOMESTIC USE,
Saves from 20 to 50 per cent. of Gas.
Gives a bright and steady Light.
Price, 15/- per dozen.
SAMPLES UPON APPLICATION.

STREET LANTERNS OF NEW DESIGNS.

IMPROVED LAMP TORCHES.
ALL BRASS. EXTRA STRONG.

PRICE LIST AND FULL PARTICULARS UPON APPLICATION.



No. 201, ⅜ B Socket.
„ 202, ½ B Socket.

No. 203, Taper Screw.

GEORGE ORME & CO., ATLAS METER WORKS, OLDHAM.
Telegraphic Address: "ORME OLDHAM."

PILKINGTON'S

PATENT GLASS LAMPS & COVERS

For Streets, Railway Platforms, &c., &c.

(Patented the 4th of May, 1889.)

This Lamp and Top, being made entirely of Glass, is perfectly impervious to corrosion, and therefore invaluable in Manufacturing and other Towns. The Top can be had in Opal, clear or coloured Glass; and is much cheaper than the old style of metal frames.

Prices on application.

PILKINGTON BROS.,
Glass Works, St. Helens, Lancashire.

"THE METEOR."

NEW HIGH-POWER GAS-LAMP,

Westphal's Patent.

Gas Companies should hire these Lamps to their Consumers, and introduce them for Street Lighting as a rival to the Electric Light, as they do not get out of order, are most economical, and the Burner being a circular slit does not choke up.

Particulars and Prices Free.

HENRY GREENE & SONS,
SOLE CONSIGNEES FOR GREAT BRITAIN & COLONIES,
153 TO 155, CANNON STREET,
LONDON BRIDGE, E.C.

S. PONTIFEX & CO.,

GAS and WATER ENGINEERS,

Manufacturers of and Contractors for the Maintenance of

PUBLIC LAMPS & LANTERNS:

GLASS—Flint, Opal, and Bent in Stock, and Cut to Sizes.

WELL LAMPS, STREET NAME TABLETS,

LAMP COLUMNS, HEAD IRONS, PUTTYLESS LAMPS,

LANTERN COCKS, REGULATORS,

Improved High-Power Lanterns for Lighting Street Refuges and Open Spaces.

BROWN'S PATENT

LAMPLIGHTERS' TORCHES.

PROPRIETORS AND MANUFACTURERS OF

BOX'S PATENT

PUTTYLESS STREET LAMP.

This Lamp may be supplied fitted with clear opal, or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing Lamps to this system can be supplied at moderate prices.

S. PONTIFEX & CO., 22, COLEMAN ST., LONDON.
Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

JOHN BROWN & CO., LIMITED,

ATLAS STEEL AND IRON WORKS, SHEFFIELD,

ALDWARKE MAIN GAS COAL.

This Coal yields 12,600 feet of 16-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE STREET, BIRMINGHAM—AGENT: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE NO. 200.

WILLEY & CO.,

GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

London Offices: 6 & 7, KING WILLIAM STREET, E.C.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS,

GASHOLDERS, Telescope and Single-Lift, any size. Some of the largest in the Kingdom erected by this Firm are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **Mr. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

W. PARKINSON & Co.,

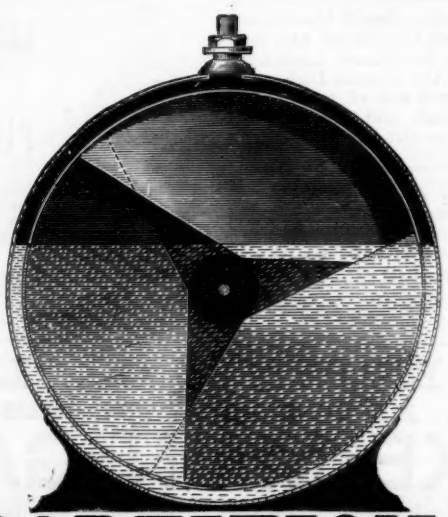
GAS ENGINEERS.

I. I. E., LONDON, 1885.

GOLD & SILVER MEDALS, I. H. E., LONDON, 1884.

MIDDELBURG, 1884.

Patentees of the THREE-PARTITION MEASURING DRUM for Wet Meters.



The Greatest Improvement ever made in the Construction of the Wet-Meter Drum.

THREE-PARTITION DRUMS

Are Fitted in ALL WET METERS made by W. Parkinson & Co.,

INCLUDING THE

OFFICIAL STANDARD TEST-METERS

AUTHORIZED BY THE BOARD OF TRADE, STANDARDS DEPARTMENT.

AND

STATION METERS OF EVERY SIZE.

Nearly **5000** Meters, fitted with Three-Partition Drums, are already in use. They work with the greatest regularity and ease, giving entire satisfaction. Both Common and Compensating Meters are rendered perfect in their action, as the Drum (being the measuring instrument) is free from any complication, and works with the greatest possible ease. Friction is almost imperceptible, while the registration is absolutely accurate.

Meters containing Parkinson's Three-Partition Drums form the simplest and most satisfactory measurers of gas in practical use.

ALSO MAKERS OF

DRY METERS OF THE VERY BEST QUALITY.

COTTAGE LANE WORKS, CITY ROAD, LONDON. TELEGRAPHIC ADDRESS: "INDEX LONDON."

[See also Advt., p. 780.

London: Printed by WALTER KING (at the office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Oct. 22, 1889.